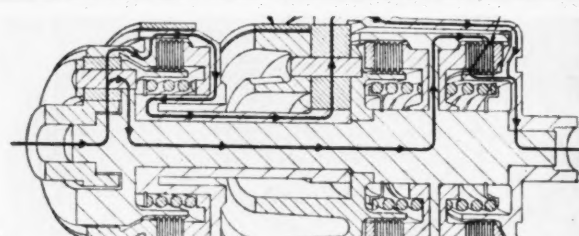
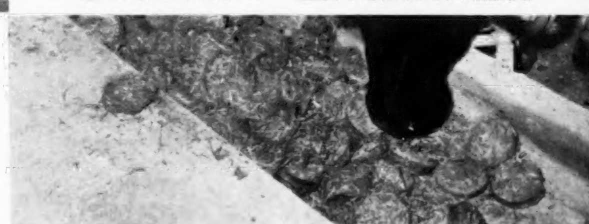
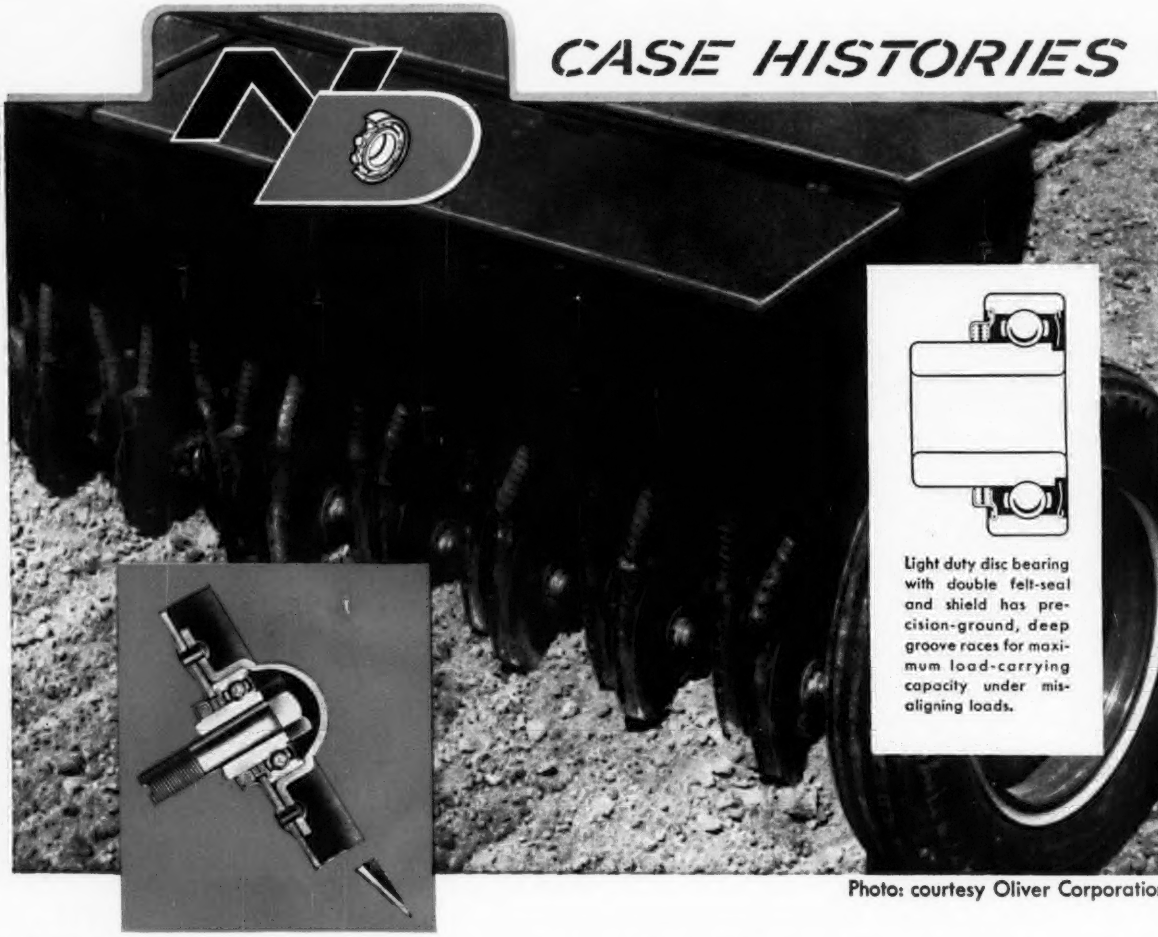
APRIL 1959

Agricultural Engineering

The Journal of the American Society of Agricultural Engineers







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N/D Sealed Ball Bearings End Dirt Contamination in Grain Drill Without Upping Cost!

CUSTOMER PROBLEM:

Freezing bearings due to dirt contamination. Grain drill manufacturer calls for bearings that will solve problem, yet not increase over-all cost.

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DIVISION OF GENERAL MOTORS, BRISTOL, CONN.

NOTHING ROLLS LIKE A BALL

Agricultural Engineering

Established 1920

CONTENTS • APRIL, 1959 • Vol. 40, No. 4

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JAMES BASSELMAN, *Editor and Publisher*

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Harold Pinches Honored . . .

Harold E. Pinches *(Center)* receives a specially bound set of Wiley's Ferguson Foundation Agricultural Engineering Series, initiated through his personal efforts. From left to right, Walker Stone, editor of the series; Mr. Pinches; and Martin Matheson, senior vice-president and secretary of John Wiley & Sons

HAROLD E. PINCHES, assistant to administrator (ARS), USDA, and Fellow of ASAE, was presented recently with a specially bound set of Wiley's Ferguson Foundation Agricultural Engineering Series, the now classic set of volumes initiated through his efforts. In a special ceremony held at 440 Fourth Ave., New York, the presentation was made by Martin Matheson, senior vice-president and secretary of John Wiley & Sons. The books were bound in ¾ green Morocco leather, gold stamped.

While serving as director of the Ferguson Foundation Mr. Pinches was primarily responsible for obtaining funds for the Teaching Seminar in agricultural engineering held at Purdue in 1946 and the stipends for each of the textbooks in agricultural engineering. His personal influence and tireless efforts were contributing factors to the success of these very important projects.

Mr. Pinches was born in 1901 at Vandergrift Heights, Pa. He received a B.A. degree in liberal arts from Ohio Wesleyan University in 1924 and an M.S. degree in agricultural engineering in 1932 from Ohio State University. He gained much in practical knowledge in agriculture during the years of 1928 to 1934 when he was intermittently employed as farmer and farm manager. In 1934 he accepted a position as head of the agricultural engineering department at the University of Connecticut, Storrs, where he remained until 1943 when he became director of farm practices for Harry Ferguson, Inc. While in this post he studied methods and equipment with a view of reducing the cost of producing crops. Following his employment with Harry Ferguson, Inc., he became director of research for American Kitchens Division, Avco Mfg. Corp., Connersville, Ind., and remained with this company until becoming assistant director of farm and land management research, Agricultural Research Service, USDA, in 1955. He has been an active Society member, having served as a member and chairman of many committees as well as chairman of the Education and Research Division in 1941-1942. He has been an ASAE member since 1935.

The books in the series presented to Mr. Pinches are:

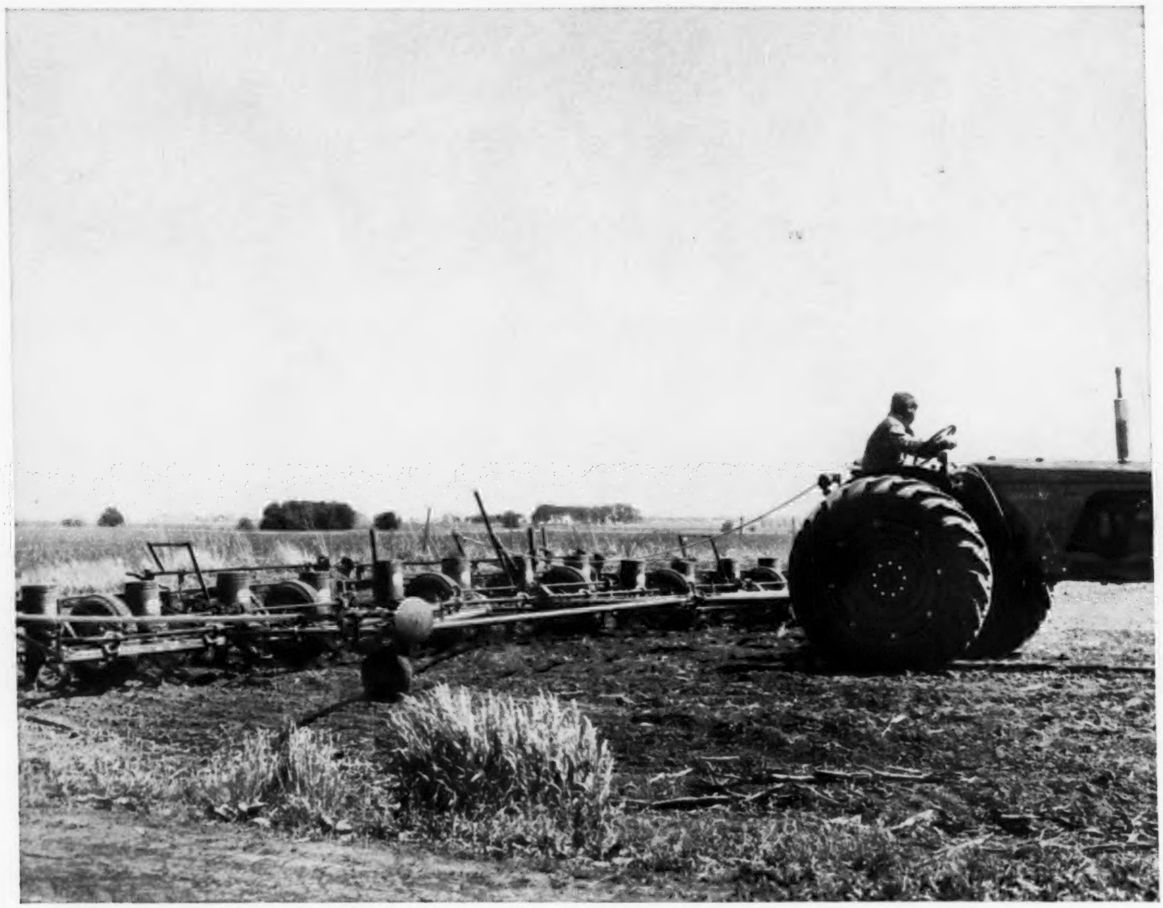
- Bainer, Kepner & Barger: Principles of Farm Machinery
- Barre & Sammet: Farm Structures
- Barger, Carleton, McKibben & Bainer: Tractors and Their Power Units
- Frevert, Schwab, Edminster & Barnes: Soil and Water Conservation Engineering
- Henderson & Perry: Agricultural Process Engineering
- Hienton: Electricity in Agricultural Engineering

He hitched 3 corn planters together...1 tractor and 1 man do work of 3!

Dollars saved in operation of farm equipment are mighty important. So Jerry Pfister, farm manager of the Pfister Hybrid Corn Co., El Paso, Illinois, hitched three corn planters together, making possible planting of twelve rows of corn at a time.

The saving — labor of two men and the time and operation costs of two tractors on the 3,100 acre farm, which produces 240,000 bushels of corn annually!

Mr. Pfister's equipment is serviced with Texaco products by Texaco Distributor Milo Sterritt of the Sterritt Oil Co., Minonk, Illinois. Long hours of field work give farm machinery bearings a real beating. But Texaco Marfak lubricant cushions the blows and stays on the job — won't drip out, wash out, dry out or cake up.



Another farmer booster of Texaco products!

Bert F. Viar, Jr., operates a 500-acre vegetable farm near Lenox, Tennessee. Shown at right, he talks with Texaco Consignee G. P. Hindman, who gives him dependable, on-time deliveries of Havoline Motor Oil and other quality Texaco products. Mr. Viar agrees with Mr. Hindman that Havoline Motor Oil is best, because it wear-proofs — and cleans — truck, car and tractor engines, assuring longer engine life and top performance. Also, he agrees with farmers in every state that it really pays to farm with Texaco products.

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TEXACO PRODUCTS

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Aetna offers you America's widest choice of ball bearing *PACKAGE* units—all described in detail in Catalog AG-57. Write for a copy or phone the Aetna representative listed in the yellow pages.

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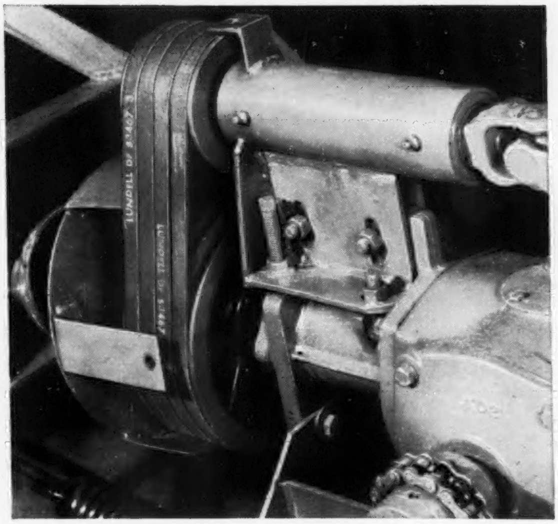
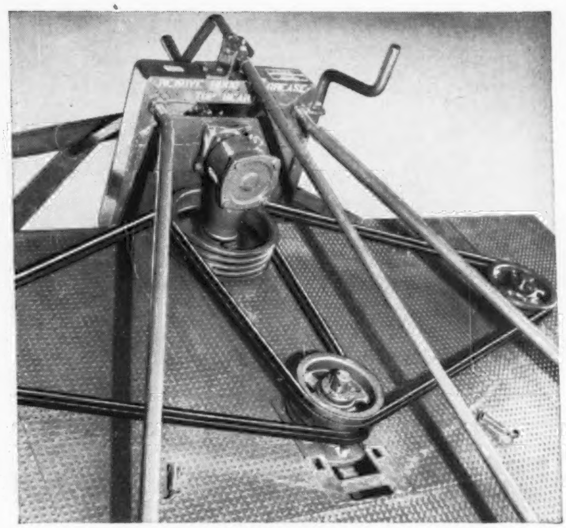


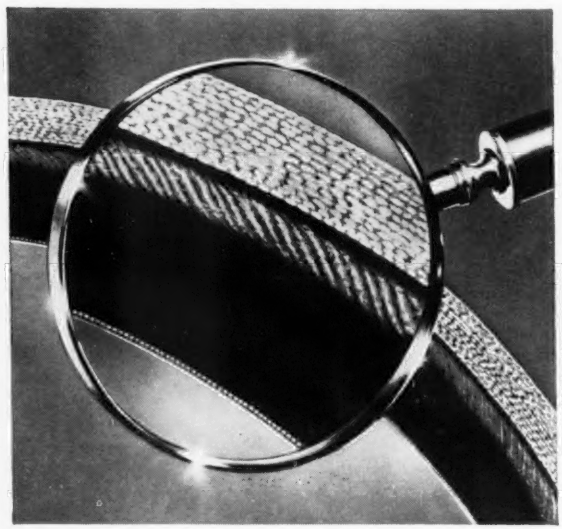
Non-Slip Power Transmission

This matched set of four Dayton Raw-Edge V-Belts is the vital link between the tractor PTO shaft and a combination shredder and hay chopper. 100% efficiency results from the non-slip performance of Raw-Edge Dayton V-Belts.



Positive Grip

Clearing brush and cutting stalks impose repeated shock loads on the cutter blades driven by this tandem set of Dayton Raw-Edge V-Belts. Yet, the positive gripping raw-edges maintain a steady flow of power at all times.



Exclusive Construction

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Dayton Agricultural V-Belts undergo all types of punishing laboratory tests. The conclusive test is conducted in the field . . . under actual conditions of weather and terrain . . . preferably on the drive for which it's specified.

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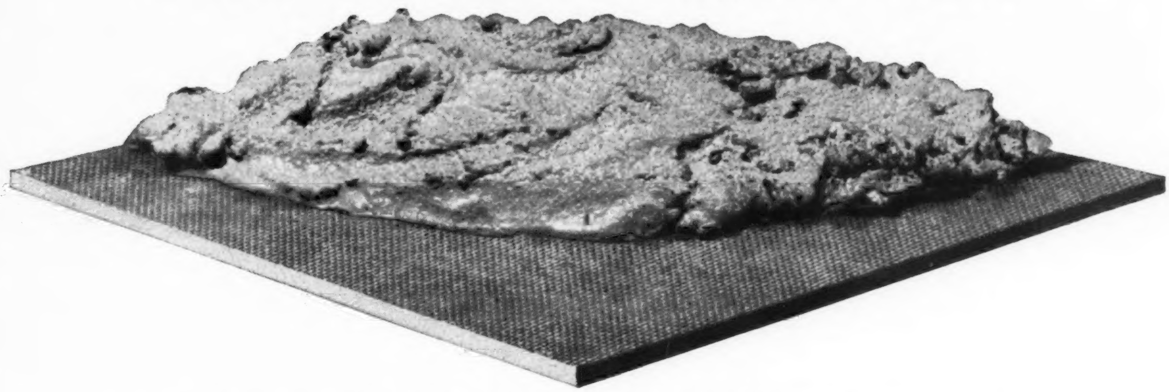

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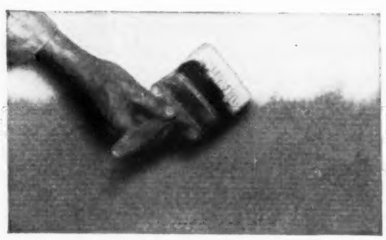

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Report to Readers . . .

CATCHER-CONVEYOR SPEEDS UP THE HARVESTING OF SMALL TREE FRUIT USDA-California AES agricultural engineers have cooperated in designing a self-propelled catcher-conveyor that has demonstrated that small tree fruit can be harvested at a rate of 30 to 50 trees an hour. The harvesting unit these engineers have worked out consists of two of the catcher-conveyors and a tractor-mounted mechanical tree shaker. . . . . In operation the two catcher-conveyors are placed on either side of a tree, and are joined together around the trunk to catch the fruit as it is dislodged from the tree by the shaker. The 20-foot boom of the shaker reaches over the catcher-conveyors and clamps around a tree trunk or limb. With this mechanized unit, such fruits as prunes, plums, and cherries can be harvested with minimum bruising of the fruit. . . . . The catcher-conveyors are built with movable canvas-covered flaps that slant toward the canvas conveyor belt. Fruit shaken from the tree rolls from these flaps onto the slowly moving conveyor, or falls directly on it. The conveyor, which forms the bottom of the machine, then carries the fruit to boxes at the rear. . . . . To operate the two catcher-conveyors and one shaker, only three men are required - less than half the seven or more men needed to handle the old-type fruit-catching frames and tree shaker. Additional labor is of course required in both cases to move and load boxes of fruit. . . . . This test catcher-conveyor was built low for maneuverability in orchards. It is powered with a 3-hp gasoline engine for traction forward and reverse and for operation of the conveyor belt. It is understood the machine will be commercially available this year.

NATIONAL COLLEGE OF AGRICULTURAL ENGINEERING APPROVED IN BRITAIN Congratulations to our British confreres are much in order just now. Word has just arrived from the Secretary of the Institution of British Agricultural Engineers that Britain's Minister of Education announced recently in the House of Commons that he had decided to establish a national college to be devoted to agricultural engineering. It is planned to build this new college at Silsoe, Bedfordshire, in proximity to the National Institute of Agricultural Engineering. . . . . For years the IBAE has pressed the need for such a college and in this effort it has had the support of the Agricultural Engineers Association (British farm equipment manufacturers' organization).

FABRIC DAMS FOR FLOOD IRRIGATION HANDLE EASIER, HAVE LONGER LIFE For flood irrigation, fabric dams have distinct advantages since they are easier to carry and do not disturb the ditch contours nearly so much as do wooden boards, dirt or sandbags. A more satisfactory material for this purpose has been canvas, but the latest development is the use of neoprene-coated nylon which weighs only about half as much as dry canvas. Nylon is not weakened by rot or mildew and dams of this material are easier to set and carry. The nylon absorbs practically no water, mud does not adhere to the neoprene coating, the dam remains flexible after long use, and with the neoprene coating the nylon is less likely to be cut with a shovel when setting the dams in a ditch. Users believe that a nylon dam will outwear several canvas dams.

ENGINEERS REPORT "CONDITIONERS" HELP TO IMPROVE QUALITY OF HAY As a result of a study last season of hay "conditioners", University of Minnesota agricultural engineers found that, in the case of material run through a crusher or crimper, it could be dried down to 22 percent moisture or less (dry enough for baling) within 29 hours after cutting, provided it was not rained on. In most cases, it is pointed out, hay that had not been conditioned could not have been baled until the third day. . . . . In these tests, four kinds of conditioners were compared, some with smooth and some with corrugated rollers. All types gave practically the same results with respect to drying.

(Continued on page 188)

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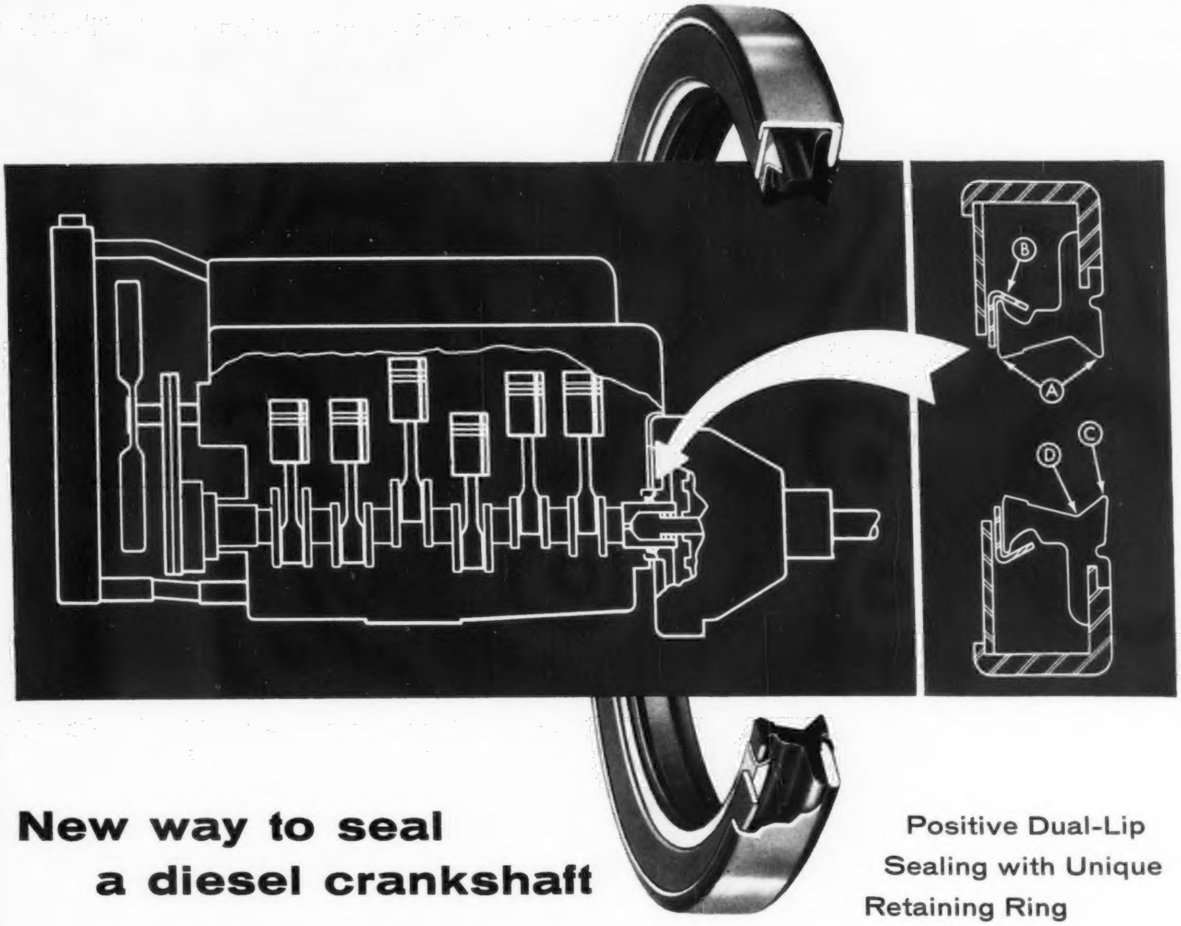

B
A
D
C

REFRIGERATED AIR RELIEVES HEAT STRESSES OF FARROWING SOWS

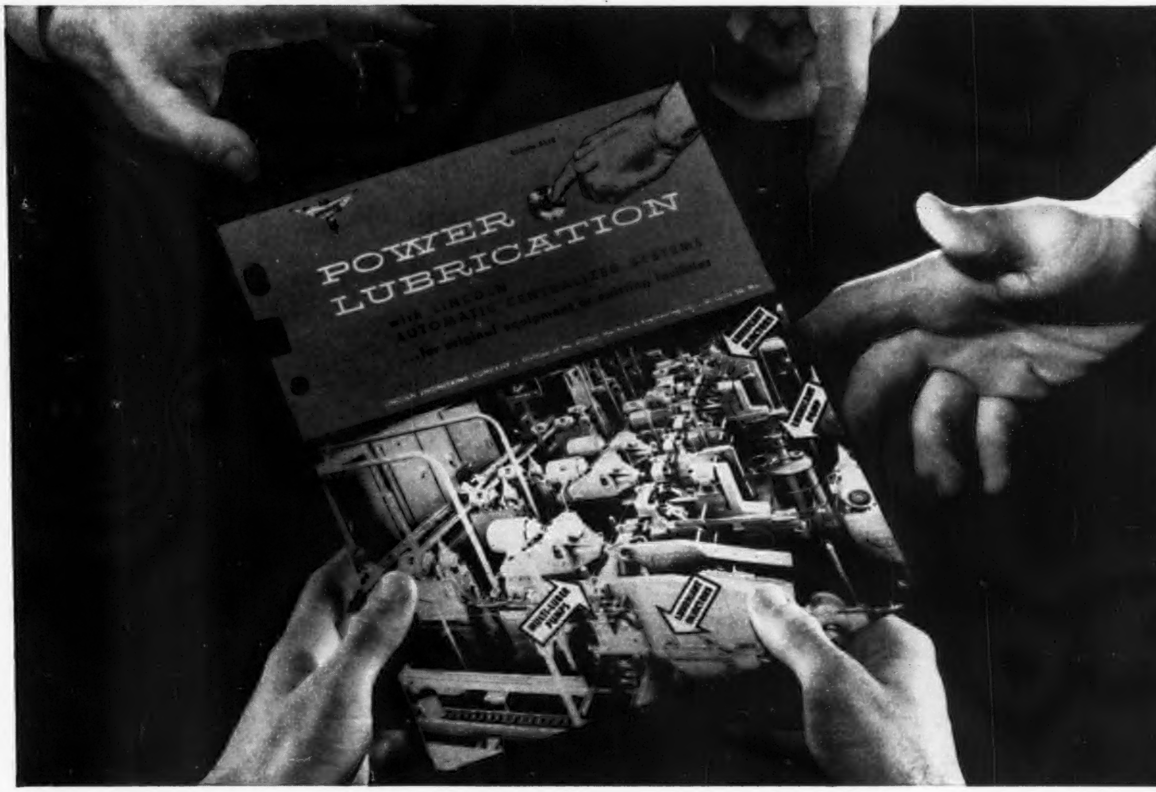
Preliminary tests conducted in a cooperative research study by USDA-Purdue AES agricultural engineers have shown that refrigerated air, when supplied in small quantities directly to farrowing sows, may be just as effective in reducing the heat stresses of the animals, under summer conditions, as would result from air conditioning the entire farrowing structure. In these tests mechanically cooled, dry air supplied at the rate of 8 cfm for breathing appeared to relieve the heat stresses of the sows confined in farrowing crates by aiding them to lose heat more readily by respiration. . . . . Less than 0.1 ton of refrigeration is theoretically required to condition this amount of air, with outside temperature at 100 F and 45 percent relative humidity. The air is cooled down to 40 F at the refrigerator to remove moisture and is then delivered by ducts directly to the front of each farrowing crate. . . . . Additional cooling effects are obtained from the refrigerated air by the envelope of cooled air around the sow when she is enclosed in an area as small as a farrowing crate, provided the crate has solid walls. Animals provided with cooling air in these tests appeared to be quite comfortable throughout the summer test period.

ENGINEERS ADVANCE NEW IDEAS FOR MACHINE HARVESTING OF POTATOES

Two ways by which harvesting potatoes mechanically could be improved have been suggested by NIAE agricultural engineers in England. One idea would be to develop strains of potatoes that could be lifted by their own tops and the tubers then stripped off. . . . . The other idea these engineers are considering is a two-stage potato harvester. With such a machine the potatoes would be removed from the ground by a two-row elevator, windrowed, and then covered with a thin layer of soil. The idea of this is that, when the potatoes are gathered later with an elevator, the clods would disintegrate more readily and the skins would have hardened and be less vulnerable to damage.

AUTOMATIC FARM TRACTOR MAGNETICALLY CONTROLLED

An automatic tractor was demonstrated recently by the farm mechanization department of Reading University (England). The tractor, driverless, left a yard, passed through two gateways, moved around a field dropping bales of straw from a converted manure spreader, then returned to the yard and stopped. It also showed that it could stop at traffic lights, blow its horn, come to a halt if it ran off course, and stop its engine if it hit an obstruction. . . . . No radio or any form of remote control under human supervision is used; the tractor is controlled magnetically by a system by which it can be given a piece of work with operational details predetermined. . . . . The tractor is steered by an electric wire laid on top of or just below the surface of the ground. When the center of the tractor is above this wire, a low-voltage alternating current induced in two coils mounted on the front of the tractor is in balance and the machine travels straight ahead. If this balance changes, resulting in variations in the course of the wire or tractor, then these react on solenoid-operated hydraulic valves which in turn control the oil supply to a double-acting hydraulic ram which actuates the hydraulic-steering mechanism. Other electric circuits can be used to start and stop the tractor, operate the hydraulic-lift arms, and engage the power take-off. . . . . This control system is not considered suitable for all types of field work, but it is believed that it can replace the tractor operator for routine hauling or carting operations over regular routes. . . . . The originators are proceeding with a full-scale research program with the idea of adapting the automatic-tractor idea to such operations as plowing, cultivating, seeding, spraying, harvesting, etc.


POWER
LUBRICATION

Agricultural Engineering

April 1959
Number 4
Volume 40

James Basselman, *Editor*

LAWRENCE H. SKROMME
President

ASAE Presidents for two terms were selected in letter ballot election closed March 31

LLOYD W. HURLBUT
President-Elect

CLOSING of the recent letter ballot in which the 1959-60 ASAE officers have been selected completed the first step in reorganization of the Council of ASAE to provide for selection of a president one year earlier than had been customary, and the selection of one councilor for each authorized and operational professional Division of the Society. Amendments to the ASAE Constitution, permitting the enlarged Council, were introduced during the 1957 Winter Meeting of ASAE and approved by the corporate membership of the Society by sealed letter ballot in June 1958.

In order to speed up the changeover to the new system, which will require three years, candidates for two terms of president were selected this year. Lawrence H. Skromme, chief engineer, New Holland Machine Division of the Sperry Rand Corp., New Holland, Pa., was elected as president for 1959-60 and will serve on the Council two years—one as past-president. Lloyd W. Hurlbut, chairman, agricultural engineering department, University of Nebraska, was elected as president-elect and will serve on the Council for three years—one year before and one year after serving as president. He will automatically succeed L. H. Skromme as president for the 1960-61 term. Complete ballot results appear on page 220.

The ASAE Council will continue to have three vice-presidents as in the past. E. W. Schroeder, head of agricultural engineering department, Oklahoma State University, was selected to fill the vacancy caused by the expired term of Lloyd W. Hurlbut. Only one new councilor was selected this year to fill the vacancy created by the expired term of David C. Sprague. A. W. Cooper, director, National Tillage Machinery Laboratory, Auburn, Ala., was elected and will be the first councilor to serve a two-year term. In the future two and three councilors will be elected in alternate years—all for two-year terms.

Addition of the president-elect to the Council this year will increase the number of Council members to ten. Selection of two councilors, one vice-president and a president-elect in the 1960 election will increase the number of Council members to eleven; however, only four divisions will be represented by councilors. The coincidence of the expiration of terms of two past-presidents and the selection of three councilors in 1961 will complete the transition. Thereafter the terms of presidents and vice-presidents will be for three years and of councilors for two years — the Council will consist of a president-elect, president, past-president, three vice-presidents, and five councilors (one for each authorized and operational professional Division of ASAE).

ASAE 52nd Annual Meeting • Cornell University, Ithaca, N. Y., June 21 - 24

Tractor Transmission Responds to Finger-Tip Control

R. L. Erwin and **C. T. O'Harrow**
Member ASAE *Member ASAE*

New transmission provides fully selective power shifting and ease of control for drives both to the tractor rear wheels and to the power take-off shaft

EFFICIENCY in the application of tractor power and the reduction of manual effort to control tractor power have been recognized accomplishments of the tractor industry in recent years. New systems for hydraulic control of implements, new systems for control of power take-off drives, new systems for operator seating and suspension, and new systems for power braking are among these accomplishments. There have been other contributions of this sort, including one which is perhaps the most useful of all to the tractor operator – the new tractor transmissions.

Without discussing these new transmissions in detail, it is probably fair to say that the ones for wheel-type tractors generally provide an underdrive auxiliary of either a mechanical or hydra-kinetic type. As far as the operator is concerned, they provide twice as many gear ratios and a means of up-shifting or down-shifting between two ratios by a simple manipulation of a control and with no noticeable interruption in the flow of power to the rear wheels.

Paper presented at the Winter Meeting of the American Society of Agricultural Engineers at Chicago, Ill., December 1958, on a program arranged by the Power and Machinery Division.

The authors – R. L. Erwin and C. T. O'Harrow – are, respectively, manager, engineering administration and services department, and chief tractor engineer, Tractor and Implement Division, Ford Motor Co., Birmingham, Mich.

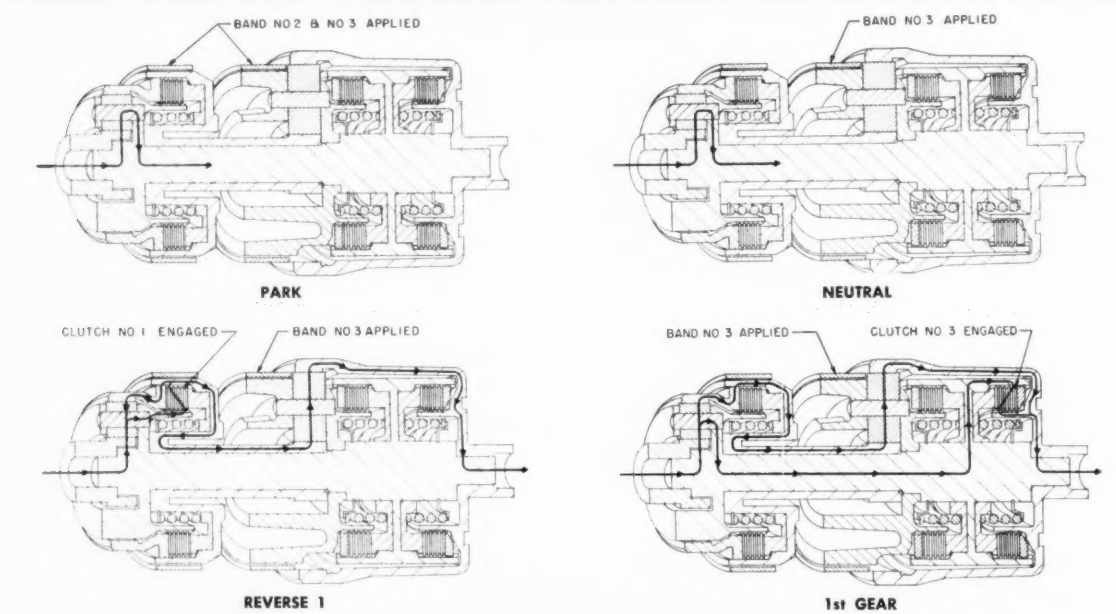
The transmission development described in this paper provides more ratios and ease of control for both the drive to the rear wheels and the drive to the power take-off shaft. It is an all new transmission which provides full power shift with finger-tip control. Ten forward speeds, two reverse speeds, and "park" and neutral positions are provided. The tractor can be started, stopped or shifted under loads from any speed to any other speed by the simple movement of the selector lever. The full range of transmission speeds can be used without stopping the tractor or using a clutch pedal; in fact, it has no clutch pedal.

The basic concepts that dictated these transmission designs were to provide *(a)* a large number of gear ratios, *(b)* power shift between all ratios, *(c)* start, stop or change gears without using a clutch pedal, *(d)* finger-tip control, and *(e)* complete lockup in all ratios so that slow engine speed in any ratio can be used for economical operation.

Power Shift

Because of the constantly changing load demands in most farming operations, it has been very difficult, if not impossible, to keep the tractor engine loaded to full capacity

Fig. 1 *(Below)* **Schematic diagram of power flow through the transmission in the five basic forward speeds, one reverse, park and neutral**



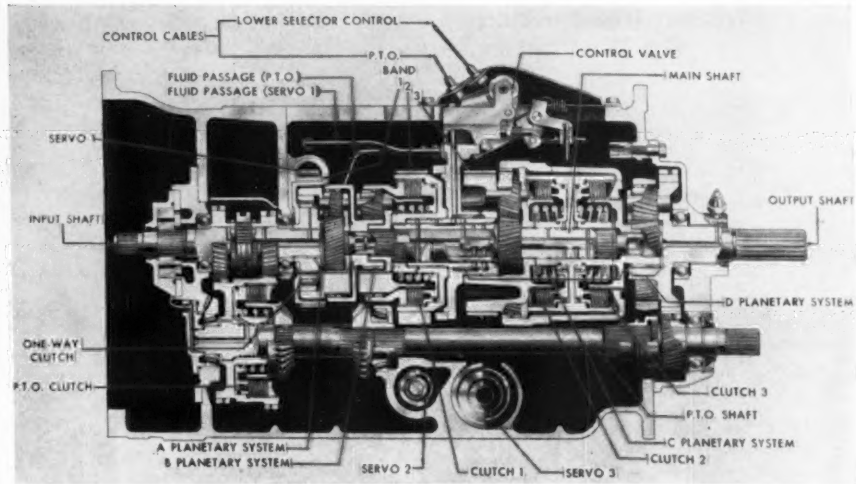


Fig. 2 Cross section of gear train of Ford tractor transmission

or at its most efficient load level at all times. Also, it has not been convenient, even with live and independent power take-offs, to change the tractor's rate of travel to keep power take-off machines at their proper capacity at all times. The ability to change speeds "on the go," whenever the changing conditions demand it, was one of the primary objectives in the design of this transmission.

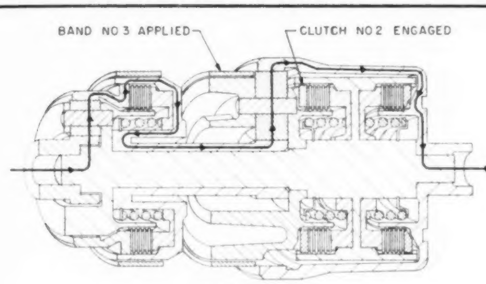
The power shift feature is provided by three hydraulic clutches and three brakes controlling three simple planetary gear sets (Fig. 2). The fourth planetary set at the rear of the transmission is a constant reduction. The diagram (Fig. 1) traces the power flow through the transmission in the five basic forward speeds plus reverse.

Of the four planetary sets, the middle two are controlled to give five forward and one reverse speed. The first set gives either overdrive or direct, making a total combination of ten forward and two reverse speeds. The design is such that no excessive pinion speeds or clutch-idling speeds are encountered. A constantly driven pump in the forward end of the transmission provides hydraulic pressure for all control functions and for pressure lubrications. The control system will be described later in this paper.

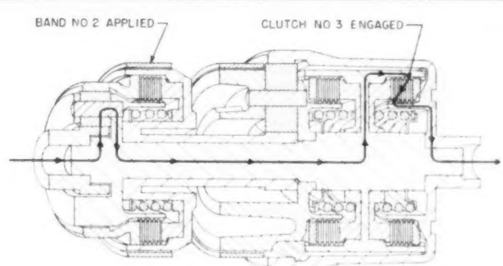
Selective Shift

The shift is made manually by the operator so that he has complete control of the ground speed at all times. He can upshift or downshift at will. The power shift has been particularly effective in power take-off work where the ground speed can be changed to suit the crop or terrain conditions without stopping the forward travel or changing the power take-off speed. For the first time the farmer has the versatility of self-propelled machines with infinitely variable speed transmissions in a tractor power take-off machine combination.

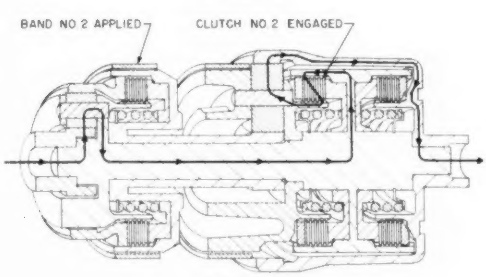
It may be questioned as to why this transmission was not designed to shift automatically. There are various rea-



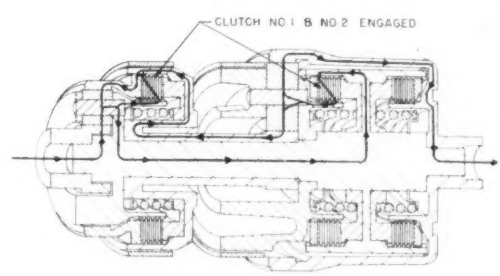
2nd GEAR



5th GEAR



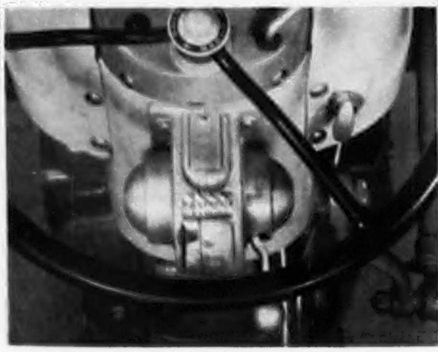
6th GEAR



9th GEAR

Fig. 3 *(Right)* Power take-off control and selector assembly

Fig. 4 *(Below)* Selector located under steering wheel. Values shown are ground speeds in miles per hour for engine speeds of 1200, 1750, and 2200 rpm.



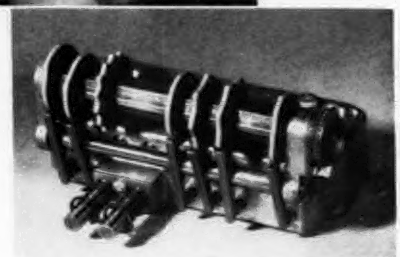


Fig. 5 *(Right)* Selector valve showing cams, valve-operating levers and feathering-valve springs

sons why it should not be automatic. Tractor loads vary so much that there would be numerous occasions when the transmission would be working on a borderline between two ratios and might get into a situation where it would be shifting back and forth between two ratios or it would tend to hunt. With an automatic transmission and to a lesser extent with torque converters, the tractor would tend to increase speed rapidly when the load is removed as at the end of a furrow. For most power take-off work and many other jobs, the operator must retain control of the speed and this speed must be independent of load. Overriding controls can be designed into an automatic transmission to satisfy most of these conditions but this would lead right back to a manually controlled power shift.

Touch Control

Shifting is accomplished by a finger-tip control lever (Fig. 4) located in the center of the tractor just under the steering wheel. The lever moves in a vertical plane.

The linkage from the selector to the transmission is by a cable which is fully enclosed from dirt and needs no lubrication beyond that provided at the time of assembling. This feature also allows freedom of design for the future if other than conventional tractor configurations are considered. The handle on the selector can be mounted either on the right or left side of the selector body.

The dial of the selector is marked with the ten forward, two reverse speeds, neutral and park. The ground speeds at various engine speeds are indicated on the selector dial. The dial is lighted for night use.

Stops or gates are provided in the selector to prevent inadvertently shifting past neutral into reverse and from reverse into a forward speed – a safety feature. Adjustable stops are also provided which can be set at selected gear ratios. Detents in the selector give the operator a "feel" so that he knows when a shift is made without looking at the selector dial, and positively holds the selector in the chosen position.

Ground Speeds

Ten forward speeds, two reverse speeds, a neutral and a park are provided in the transmission. Fig. 6 is a chart of the ground speeds. A good range of speeds is provided for all types of tractor work. The ten speeds also keep the ratio change from one speed to the next to a minimum. This is necessary for a good power shift. Within the limitations of the planetary gear train, the steps in ratio change are kept as even as possible.

Automatic Parking Brakes

In addition to neutral, a park position is provided in the transmission. When the selector lever is moved to the park position, two of the transmission band brakes are engaged, locking the rear wheels. This is a band-type lockup and not a detent-type lock as in most automotive-type transmissions. The transmission can be put in park even though the tractor is moving.

Another feature of this automatic parking brake is that it is automatically engaged whenever the engine is stopped regardless of the position of the selector lever. The two bands are spring-engaged and as soon as hydraulic pressure is lost the bands lock up. There is a slight delay between the time the engine is stopped and the transmission is locked up (1 to 3 seconds).

The question may be asked as to what happens if the engine is accidentally killed. If going down hill with the tractor in gear and the load is sufficient to turn the engine over, the transmission will remain in gear as long as the selector is not moved. If the selector is moved, the engine will stop and the transmission brakes will be applied. The differential in the tractor will give even braking for a safe stop. If the tractor is going up hill and the engine is killed, the transmission brakes will be applied.

Transport Disconnect

To move the tractor when the engine is not running or for towing behind a truck, which is commonly done with tractors used for industrial work, a mechanical disconnect is provided between the transmission and the ring gear and pinion. This makes it unnecessary to provide a rear pump to lubricate the transmission while towing.

Feathering Control

A feathering control is provided to maneuver the tractor for hitching and unhitching, for starting loads slowly or any other purpose that the operator would normally feather a tractor clutch. The feathering control is also a safety feature because it is controlled by a foot pedal located in the normal position for the tractor clutch pedal. The tractor can be stopped by pushing the pedal regardless of the position of the selector lever. When feathered, the parking lock described before is not engaged.

Safety Starting

The starter switch is interlocked with the selector so that the tractor must be in the park position before the starter can be actuated. The transmission brakes thus remain locked until the selector lever is moved to the desired speed setting. The selector lever can be moved from park directly into any forward or reverse speed and the tractor will start out in that speed. It is common for experienced operators to go from neutral or park to a plowing speed without using the feathering control.

Independent Two-Speed Power Take-Off

The power take-off is the independent type and is operated by a push-pull button on the sheet metal near the steering wheel (Fig. 3). Combined with the power shift feature of the transmission the independent touch control power take-off gives added efficiency and speed of operation to power take-off work. Speed changes are so easily made that the operator will keep his power take-off machine loaded for best results at all times. He will not crowd it and risk clogging or loss of grain in heavy spots and he will increase speed in light spots keeping his machine load up. He will also disengage the power take-off and speed up ground travel even on short head lands. It has been noted that operators will even disengage the power take-off on turns to reduce universal joint clatter.

The power take-off clutch is also a hydraulic clutch and is on the lower or power take-off shaft (Fig. 2). This clutch is interlocked with the ground-drive power take-off clutch so that it cannot be engaged if the ground-drive power take-off is engaged.

The power take-off has two gear ratios in addition to the ground drive. These can be used to provide for a standard power take-off speed at two engine speeds, one for economy and one for power, or they can be used to provide two standard power take-off speeds at one engine speed. The power take-off ratio can be changed only when the tractor engine is stopped and is shifted by a lever on the side of the transmission.

Ground-Drive Power Take-Off

A gear on the carrier of the rearmost planetary set driving a gear on the power take-off shaft (Fig. 2) provides a ground-interpreting power take-off speed. This feature has application to such implements as mowers, rakes, planters and fertilizer spreaders where it is desirable to have a power take-off speed relative to speed of forward motion.

Side Power Take-Off

The design provides for the addition of two side power take-offs, one on either side of the tractor. These power take-offs will run at the same speed as the rear power take-off and otherwise conform to ASAE standards. Access plates are provided on the sides of the transmission for installing the side power take-offs.

Controls

All transmission clutches and brakes are actuated by hydraulic pressure. Each unit is controlled by a cam actuated valve in the valve body (Fig. 5). The cams have a position for each of the ten forward speeds, two reverse speeds, neutral and park. All brakes and clutches are pressure actuated, except the second and third brake, which are spring loaded and released by applying hydraulic pressure. The two brakes are spring loaded and any time pressure is removed from both of them they are applied and the transmission is locked from moving. This happens either by moving the selector lever to "Park" or automatically any time the engine stops and hydraulic pressure is lost.

Since band 2 and 3 cannot be on at the same time without the transmission being locked up, they must be interlocked. Interlock valves are in the line to each brake servo (Fig. 7). The brake servos are spring loaded so the hydraulic pressure actually disengages the bands. The servo valves are mechanically connected to the opposite servo stem

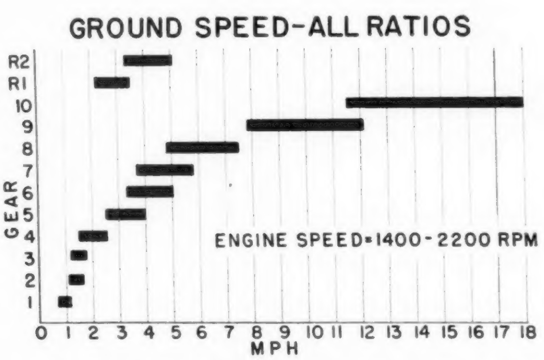


Fig. 6 Ground speed range (all ratios) for engine speeds of 1400 to 2200 rpm

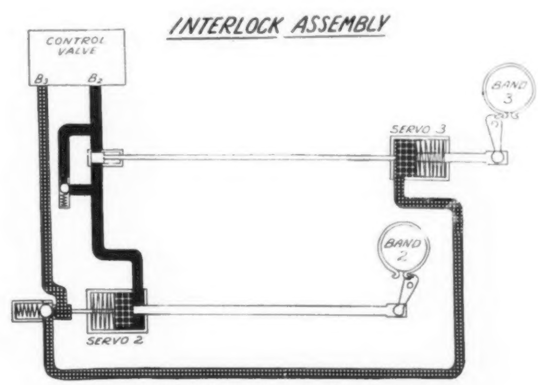


Fig. 7 Hydraulic schematic of servo interlocks

. . . Tractor Transmission

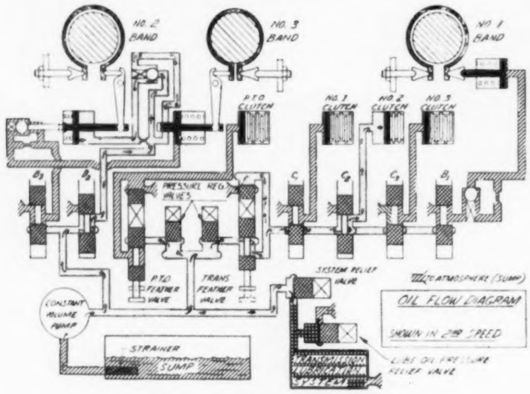


Fig. 8 Transmission hydraulic system

so that hydraulic pressure must move one servo through enough distance to disengage that band before the interlock valve opens enough to allow pressure to bleed from the other servo engaging that band. For instance on a 4 to 5 shift, band 2 is engaged and band 3 is disengaged. Thus pressure must be applied to servo 3 and the servo for band 2 must be exhausted. As pressure is applied to servo 3 it moves against the spring pressure disengaging band 3 and opening the servo 2 interlock valve. When this happens servo 2 is exhausted and band 2 is applied.

Check valves are used to bypass the interlock valves so that pressure can be applied to either servo regardless of the position of the other. Pressure is applied to both in 9th and 10th gears. Also a controlled bleed is allowed around the interlock valves so that the transmission will go into park in about 3 seconds, regardless of the position of the selector if the engine is stopped so that hydraulic pressure is lost.

The hydraulic circuit (Fig. 8) is set up so that no slipping is taken on the bands. The two main bands are separated from the clutch circuit by a pressure-control valve. This valve remains closed until pressure enough to actuate the bands has built up before it allows pressure to build up in the clutch circuits. Fig. 9 shows which elements are pressurized in the various gears.

The clutch circuit is also used for feathering the transmission. A feathering valve in the clutch circuit is controlled by a foot pedal. This valve is basically a manually controlled relief valve with an off position to insure zero pressure on the clutch, preventing drag when the foot pedal is depressed all the way. First movement toward engagement of the feathering valve closes the sump passage in the clutch circuit and opens the pressure port. Further movement of the feathering valve compresses the feathering valve spring, gradually increasing clutch pressure. This variable-pressure control is very important in good control of the clutches. The spring-controlled relief valve makes the pressure independent of oil flow and viscosity.

When a shift is made the appropriate valves are moved by the cams bleeding pressure from some units and pressurizing others. This change is made as rapidly as possible and is controlled only by the capacity of the pump. Normally the feathering valve is not used in making a shift. Tests have shown that the shifts must be made rapid enough to prevent loss of load if they are to be satisfactory.

A feathering valve and pressure-control valve are also provided in the valve body for the power take-off clutch. This is separate from the other hydraulic circuits interlocked only by the two pressure-control valves. The pressure-control valves prevent loss of pressure in one part of the circuit if pressure is dropped in another circuit, as it is when a shift is made or when either the power take-off clutch or transmission clutches are disengaged by feathering. The power take-off valve is controlled by a push-pull wire to a knob near the steering wheel on the sheet metal (Fig. 3).

One main relief valve in the valve body controls the pressure after any change takes place. This controls the pressure level at about 220 psi. The oil from this valve then goes into the transmission main shaft and is used for pressure lubrication of all clutches and bushings in the main power train.

A restriction was placed in the No. 1 brake circuit to reduce its engagement time. Early tests showed that unless this restriction was provided the No. 1 or overdrive brake would operate before the clutches were completely disengaged, making a distinct bump in some ratio changes. The restriction is by-passed by a check valve for rapid disengagement.

Typical pressure curves are shown in Fig. 10, for the 4 to 5, 5 to 6 and 6 to 7 shifts. These shifts show most of the changes. The axle torque will change from those shown depending on the type of load but the pressure readings will remain the same. The curves were made with a disk harrow in a plowed field.

PRESSURE CHART

GEAR	P	R1	R2	N	1	2	3	4	5	6	7	8	9	10
BAND NO.3									X	X	X	X	X	X
BAND NO.2		X	X	X	X	X	X	X					X	X
BAND NO.1			X				X	X			X	X		X
CLUTCH NO.3					X		X		X		X			
CLUTCH NO.2						X		X		X		X	X	X
CLUTCH NO.1		X	X										X	X

X=PRESSURE APPLIED

Fig. 9 This chart shows the power units pressurized in each gear

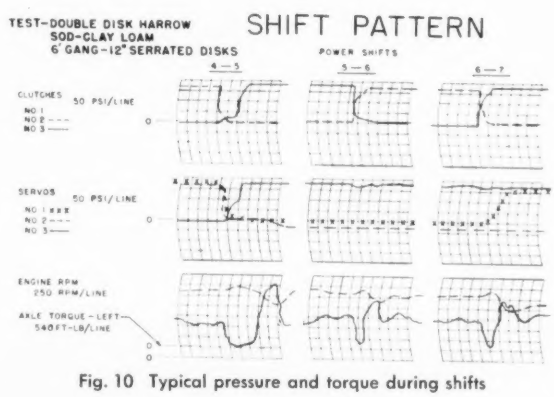


Fig. 10 Typical pressure and torque during shifts

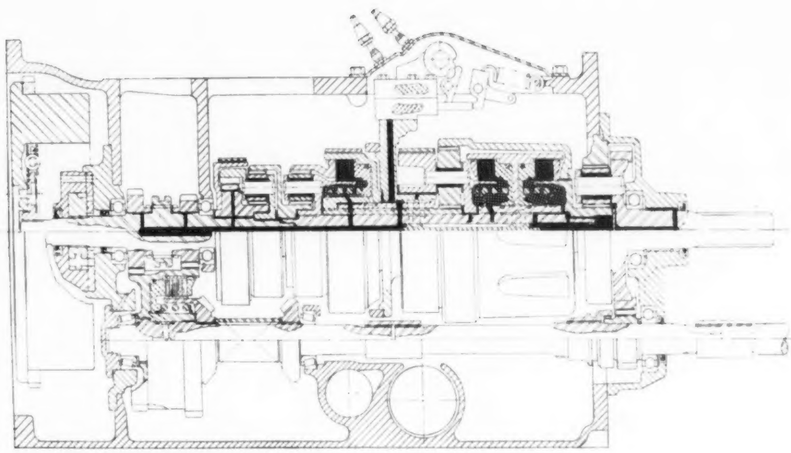


Fig. 11 Pressure lubrication to all bearings and clutches in main gear train

The 4 to 5 shift is the slowest because more changes take place than in any other ratio change. The No. 2 clutch is disengaged, the No. 3 clutch is engaged, the No. 1 brake is disengaged, the No. 3 band servo is pressurized disengaging that band and pressure is vented from the No. 2 band servo engaging the No. 2 band. As was explained before, the No. 2 and 3 bands are spring loaded for engagement so that pressurizing those servos disengages the bands. Note that the pressure on the No. 2 band is close to zero before the No. 3 band is pressurized and that the pressure has built up enough in the No. 3 band servo before pressure is applied to the No. 3 clutch. Thus the No. 2 clutch is the only unit picking up a load under dynamic conditions.

The only change in the 5 to 6 shift is changing the pressure from No. 3 clutch to No. 2 clutch. These changes are simultaneous depending on the characteristics of the clutches for a good shift. In the 6 to 7 shift the pressures to clutches 2 and 3 are again reversed and brake 1 is applied. Seventh is an overdrive of fifth. Tests have shown that the shape of the valve cams have very little to do with the shape of the pressure curves. The volume of oil supplied by the pump and the characteristics of the clutches and servos are the controlling factors.

Lubrication

After all shift actions have taken place, the main system relief valve maintains the hydraulic system at operating pressure. The oil from this valve then is channeled into the main shaft to provide pressure lubrication of all bushings and bearings and maintains a flow of oil through the three clutch packs (Fig. 11). In this type of transmission where clutches are running open with relative motion, it is very important that good lubrication be provided to them.

Mechanical Features

The overall package size and mounting flanges of this transmission are the same as the standard transmission presently in use. In this way there is complete interchangeability without any major changes to the other parts of the tractor. This has necessarily produced a very compact design. The pump is built into the front support and is of the roller vane type. The valve body is made of two die-cast halves and is fastened to the center support member of the transmission which is drilled to distribute oil to the center of the shaft.

Care was also exercised to produce a balanced design. With the very high reduction ratios in the low gears it is not practical to design for full engine torque through the transmission because traction would always be a limiting factor. Therefore, two design parameters were established, one for maximum drawbar pull and one for maximum engine input torque. In the higher gears the engine torque is the limiting design factor for strength and capacity, and in the lower gears drawbar pull is the design factor.

The planetary gear train also is ideally suited to give a high capacity in a small space. All the planetary sets are allowed to float around one member thus allowing the loads on the pinions to be equally distributed. This design was fully justified in early tests when some of the bushings and shaft fits were made closer than was intended and trouble was immediately encountered.

Although the carriers and pinions are the only parts of the transmission that require precision in manufacturing, it is felt that special plant facilities are necessary. The greatest enemy of this type of transmission during manufacture is dirt, particularly air-borne dirt. Clean conditions are necessary. All hydraulic components are run over test fixtures before they are assembled into the transmission. Then the completed transmission is tested.

Field Performance

The proof of any particular set of design specifications is the reduction to field models and actual use under field conditions. In the case of this transmission, the results have been more than gratifying.

In actual field use the transmission approaches the flexibility of an infinitely variable speed transmission but retains the efficiency of a gear-train reduction. The reason, of course, is the fixed reduction in any one gear after a shift has been made, and the shift can be made throughout the entire range so easily that an operator is not reluctant to shift. In fact, it is so easy that with new operators it may be desirable to provide a vacuum gage or other instrument to indicate to the operator when the engine is at its best load.

The ten speeds forward seem to provide an optimum range for this type of transmission. Fewer speeds would

(Continued on page 207)

Fig. 1 Pellets discharged from an extrusion machine leave the die as a long cylinder but on standing tend to separate into individual wafers equal to the individual charges fed to the extrusion cylinder at each stroke of the compressing piston. These pellets 4 in. in diameter range from ½ to ¾ in. in thickness

Developments in Pelleting Forage Crops

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Member ASAE *Student Member ASAE*

A review of feeding-trial results, stability of forage pellets, development of pelleting machinery

WITHIN the last ten years perhaps no one phase of farm mechanization has been the subject of so much interest as the pelleting of livestock feed. Probably this interest has resulted not only from reports of feeding trials which indicated phenomenal gains on pelleted feeds as compared with ordinary feeds, but also because of the great interest in mechanization of feeding systems and the general tendency toward consolidation and expansion of livestock handling operations. Pelleted feeds, not only those of grain concentrates but also of forages and complete rations, lend themselves to automatic or self-feeding better than any other form of feeds now available. This has so stimulated the imagination of many people that within the last year numerous research reports, news releases and articles on various phases of pelleting and feeding have been published.

Paper presented at the Winter Meeting of the American Society of Agricultural Engineers at Chicago, Ill., December 1958, on a program arranged by the Electric Power and Processing Division.

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Acknowledgment: The authors are indebted to the International Harvester Co., through whose cooperation, including an industrial grant to the University of Wisconsin, some of the pellet research reported in this paper was made possible.

Pellet Feeding Trials

Sufficient nutritional studies have been reported on the feeding of conventional pellets (hard pellets consisting partly or entirely of ground forage) that they need be mentioned only briefly here. Feeding of such pellets has been shown to vary from a break-even point to being very profitable in feeding poultry, steer calves, lambs, etc., and to have as well definite advantages in the way of mechanical handling, self-feeding, reduction of waste, and saving in storage space and transportation costs. This same type of pellet, however, when made of finely ground forage has not proven desirable as a feed for dairy cows(1)*.

*Numbers in parentheses refer to the appended references.

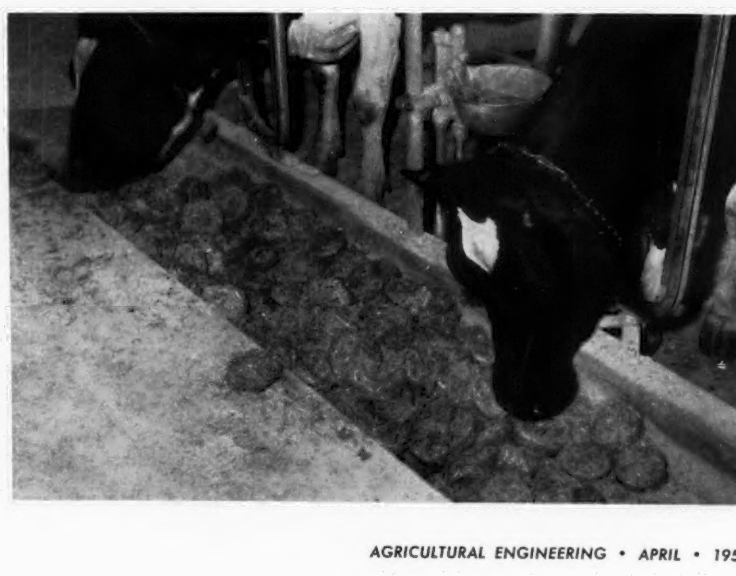

Fig. 2 Dairy cows experience no apparent difficulty in eating the large forage pellets. Actually the daily feed of pellets is consumed in appreciably less time than the equivalent amount of baled hay. Rumination time is essentially the same on both types of feed

More recently a number of feeding trials have been reported where large pellets, 3 to 4 in. in diameter and approximately 1 in. thick made of chopped or long hay, were fed to dairy cows.

In a recently reported study Jones, Magill, and Peterson(2) at Oregon State College fed 18 milk cows over three four-week periods, using 36 tons of good quality, second cutting, baled alfalfa hay. One-third was fed from the bales, one-third was chopped into 1 to 2-in. lengths and machine compressed into 1 x 3 in. wafers, and one-third was ground in a hammer mill with a 5/16-in. screen and pelleted to a 1/2 x 3/4-in. size. Statistical analysis of the data showed no significant differences in feed consumption, milk production, or body weight of cows fed the hay in the three different forms.

It is interesting to note that only slight depression of butterfat content was found in the milk from cows fed the ground and pelleted hay (4.14 percent for baled and wafered hay and 4.00 percent for the pelleted hay). Grinding through the 5/16-in. screen gave a rather coarsely ground alfalfa meal which on feeding as pellets apparently did not produce the extreme butterfat depression reported by others using finely ground forage either as meal or incorporated in pellets.

Similar research has recently been conducted by Niedermeier, Bringe, and Larsen(3) at the University of Wisconsin. In these feeding trials high-quality alfalfa baled hay was fed both as baled hay and as pellets made from the baled hay. The pellets were 4 in. in diameter by 1/2 to 1 in. thick, of a density of 25 to 30 lb per cu ft, and were made by compression of the long baled hay in an experimental machine supplied through the cooperation of the International Harvester Company. An analysis of the data showed that the intake of pellets was significantly greater than the intake of long baled hay in the first trial. In a second trial, however, there was no significant difference. No statistically significant differences were present in either trial in regard to production of 4 percent fat corrected milk or body weight.

Further research with four cows has shown that the ruminating time was essentially the same, although the cows ate a full feed of pellets slightly faster than long baled hay.

Unpublished reports on other similar feeding trials, in which long hay is compared with the large pellets made of long or chopped hay, are very much in agreement with the previously reported work. Therefore, on the basis of these tests and on previous work with pellets made of finely ground forage, a logical conclusion is that, if only pellets are fed, two types of pellets are necessary, the coarse large type made of chopped or long hay for dairy cows and the conventional ground-forage pellets for other livestock.

Pellets of the proper size, density, and consistency will be utilized by the average dairy cow as well as hay in any other form. No appreciable increase in production can be expected. The feeding of pellets to dairy cows must be decided on its advantages in handling, storage, feeding, and transportation.

As yet no research reports have come to our attention on feeding beef cattle the large-size forage pellets, although there are indications that this is being practiced in a limited way.

The degree of fineness of grinding which causes fat depression has not been precisely established as yet, although there are indications (1) that it is in a range finer than a normal coarse grind. Jones (2) reported only slight fat depression in milk from cows fed his ground-hay pellets (5/16-in. screen). Several months ago farmers were reported to be feeding the ground-hay type of pellets with limited or no fat depression. In some cases small roughage supplements of loose hay or silage were given. In one case the cattle were actually reaching back and eating the bedding in order to get sufficient roughage to compensate for the difficulties of a diet of finely ground roughage. Recently, however, reports have come to our attention that farmers previously reporting satisfactory results in feeding a ration in which all of the forage was ground, mixed with concentrates, and pelleted are now experiencing various difficulties such as higher rates of feed consumption without higher production and excessive weight gain. Considering the early nutritional studies of Powell, Loosli, Allen, Stoddard, Tyznic, and Rodrique (for bibliography see reference 1) these developments could be predicted.

Terminology

Presently the agricultural engineering profession is confronted with confusion concerning the terms to use for forage crops compressed into semisolid forms of various shapes. The word "pellet" was first used. However, this leaves some confusion as to size and as to whether the forage was ground, chopped, or long before forming the pellet. The term "wafer" has more recently been used in connection with a hay package of long or chopped forage 3 to 4 in. in diameter and about 1 in. thick. This seems to be a fairly good descriptive term for such a form. However, it is quite possible that someone may produce another cylindrical form of smaller diameter and greater length, and forms similar to a biscuit, coal briquet, or plug tobacco are quite possible, and under these conditions the term "wafer" would be quite absurd. For that reason, in this paper the compressed form is referred to as a "pellet" to await such time as shape and size become standardized.

Stability of Forage Pellets

In our research work since 1952 on forage pellets of long or chopped hay, we have made many observations on the physical characteristics of the pellets produced.

Forage pellets compressed in a closed cylinder or extruded through a tapered tube have a tendency to expand as the pressure is released. The expansion takes place primarily in the direction in which the load was applied. However, there is also limited expansion in the diametral direction which is probably of little economic importance. On the other hand, expansion along the axis of major compression may be of considerable magnitude even to the extent of distintegration of the pellet.

Although all factors affecting the magnitude of expansion probably are not known at present, nor what their exact relation to expansion is, the following factors appear to have an appreciable effect on pellet expansion:

1. Pressure applied
2. Hold time under pressure
3. Moisture content of the material
4. Other characteristics of the material itself such as the kind of crop, stage of maturity, leafiness, etc.

High pressure, of course, results in a more dense pellet. Expansion of high-pressure pellets over a period of time

is of about the same magnitude as that of lower-pressure pellets. Although some variation has been observed, it was not sufficiently consistent to establish a trend as yet. This expansion in relation to time is shown by the slope of the curves in Fig. 3. The actual density of the individual pellet is indicated by the vertical component.

A longer hold time at a given pressure increases the pellet density. Pellets made with the longer hold time tend to expand slightly more than those made with the shorter hold time, so there is a tendency toward a convergence. However, even at 1,000 hr of free expansion, the longer hold-time pellets were still more dense than the short hold-time pellets. Fig. 4 shows this tendency toward convergence of densities of high moisture pellets.

Moisture content of the material being pelleted is very important. Fairly satisfactory alfalfa pellets can be made up to 30 percent moisture. At higher moisture content the pellets tend to be less stable, and at 35 to 37 percent moisture the pellets on drying consistently expand beyond practical limits. This is shown in Fig. 5. The density of the pellet made at 36 percent moisture dropped rapidly.

Limited observations indicate that it is necessary to dry pellets to a maximum of approximately 20 to 25 percent moisture for satisfactory storage. High-density, high-moisture pellets stored in open air have shown slightly more tendency to mold than pellets of equal moisture but lower density.

It has been reported that difficulty was experienced in producing pellets with a field machine when the hay in the windrow was above 20 percent moisture. Part of this discrepancy in apparent maximum allowable moisture may be due to the fact that a windrow at an average moisture content of 20 percent may have some portions at considerably higher moisture as well as some drier portions. Under some conditions alfalfa at 25 percent moisture tends to deposit gum on the pelleting equipment.

Minimum moisture is probably of little importance in the performance of a field-pelleting machine but may be important in stationary machines pelleting artificially dried forage. Closed-cylinder pelleting can be carried on at very low moisture. Alfalfa at 6 to 8 percent moisture is readily pelleted in a closed cylinder, while difficulty was experienced in this same range in making pellets by forcing the forage through a tapered tube (extrusion type), especially where considerable brome grass was mixed with the alfalfa. Spraying a very small quantity of water on the material improved its pelleting qualities. This is a common practice with conventional pellet mills. Another interesting observation, probably of little practical value, is that snow falling on very dry material as it was fed into a pelleting machine semed to improve the pelleting qualities. The allowable moisture range for other materials may be quite different from alfalfa.

Almost any material can be pelleted provided it is within the proper moisture range, and if the equipment can exert sufficient pressure.

Some materials pellet at much lower pressures than others. Alfalfa and clover are quite readily pelleted while oat straw is difficult to pellet. Low moisture in the oat straw is not necessarily the only factor responsible for the poor pelleting characteristics. Oat silage at various stages of dryness was also difficult to pellet. Grass silage (alfalfa and clover), if partially dried, could be pelleted. However, it did not seem to pellet as well as ordinary alfalfa and clover hay.

Brome grass does not pellet as readily as alfalfa but is more easily pelleted than oat straw or dried oat silage. Materials which are difficult to pellet seem to give much more trouble in the extrusion-type process of pelleting. The limits appear to be much narrower in this process.

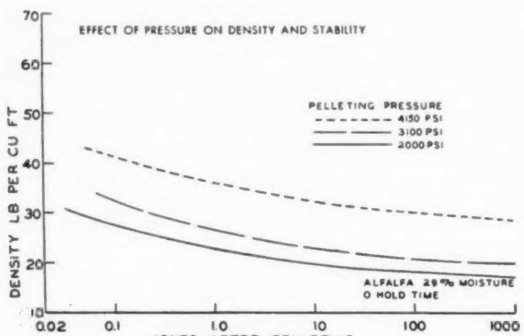

Fig. 3 While there is a definite correlation between pellet density and compression pressures, no appreciable correlation has been established between pelleting pressure and expansion of the pellet after removal from the compression chamber

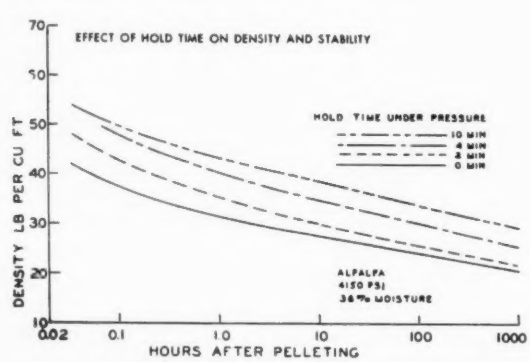

Fig. 4 There is a definite correlation of hold time and pellet density. However, pellets formed at a long hold time tend to expand slightly faster than those of short hold time. There is a tendency toward convergence of density

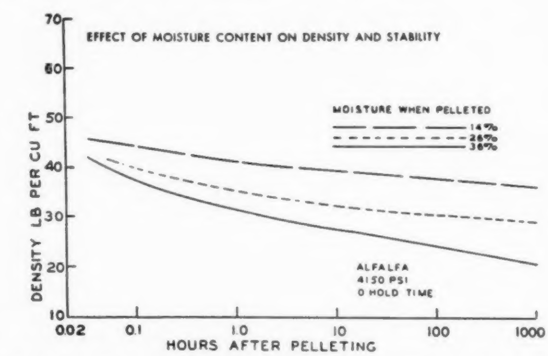

Fig. 5 High moisture content results in less dense pellets (dry matter basis) and also in greater expansion of the pellets which causes further divergence in density over a period of time.

Stability of Pellets in Storage

Expansion of pellets immediately after being ejected from a pelleting machine and for the following few days can be very misleading. One year ago we pelleted a quantity of mixed alfalfa and brome grass with an extrusion-type machine in which a piston forced the forage through a tapered tube approximately 4 in. in diameter. The amount of material fed to the machine on each stroke of the piston formed one pellet approximately one inch thick. Although the discharge of the machine appeared to be almost a continuous cylinder, there was a definite cleavage plane between the individual pellets or wafers. On standing in the open, these cleavage planes tended to separate, giving the impression that the pellets were expanding two to three times the original thickness. Most of these pellets were discharged from the machine directly into standard burlap bags. They were tied and put in storage. Now approximately one year later the bags appear to be well filled. However, none of the bags has burst, and none of the tying strings has been blown off. Thus it appears that, while expansion of pellets does take place, it probably is much more extensive if pellets are in the open than if the expansion is somewhat restrained, such as might be brought about by bagging or storage bins.

Effect of Rewetting on Pelleting Expansion

Unrestrained forage pellets expand considerably as a result of being water soaked, which led us to think that there might be serious consequence due, for instance, to a leaky roof on a bin filled with pellets. As a result of an accident, several bags of forage pellets were soaked to the point where serious spoilage of the pellets took place. The bags, however, did not burst and on close observation, it appeared that the expansion took place only in areas where free expansion was possible. Some pellets became wedge shaped instead of having the normal shape of a section of a cylinder. Therefore, expansion of rewetted pellets may not be serious, although the pelleted forage molds and rots as a result of getting wet just like hay in any other form.

Pelleting Machinery

Machines for making the small pellets of ground material are standard items of production and are available from numerous manufacturers. These machines, while primarily designed for stationary use, have at times been equipped with wheels or mounted on trailers with auxiliary equipment such as grinders and coolers to make a portable machine. In most cases the maximum portability consisted of hauling them to the farm or to the field and then bringing the material to be pelleted to the machine. They were large, heavy, clumsy assemblies and still made the standard small ground-hay pellet.

Recently the Sumner Iron Works has put on the market a commercial machine to produce the large pellets made of chopped forage. It is available as a stationary machine or trailer mounted. However, it is of such weight, size, and cost that it should be considered as a machine for a feed processor or for a farm of such size that the operation would be equivalent to that of a processing plant.

Many are looking forward to the development of a machine for ordinary farm use, and at least two of the major implement manufacturers have released limited information on experimental portable field-forage pelleting machines.

There was a great deal of interest in the report(4) by May of the International Harvester Company's field pelleting machine which will pick up hay from a swath, form pellets, and load into a trailing wagon. Limited information on an experimental pelleting machine has also been reported by McClellan and Callum(5) of the John Deere Ottumwa Works. Other manufacturers have experimental equipment about which no information has been officially released as yet.

The fact that machinery to make large pellets of chopped and long hay is now heavy, expensive, and of limited capacity is, of course, frustrating both to the engineers and to the farmer who would like to buy a machine for next year's crop. However, we need to consider how long the stationary hay press was in development and how long it took to get a self-tying field baler. The field forage harvester required about 10 years from the first experimental model to the first commercial machines, and many of us remember some very heavy and clumsy tractors with a maximum of two forward speeds both of which were slow.

One factor in favor of more rapid development in forage-pelleting equipment is the demand there seems to be for such a machine, even before it exists, and it is only within the last year that we have had extensive feeding trials sufficient to prove that the pellets we wanted to make were actually desirable as a dairy cattle feed.

The cooperation of equipment manufacturers who have devoted research engineering talent and funds to developing pilot machines for providing forage pellets for the feeding tests going on across the country in college laboratories is much appreciated

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. . . Tractor Transmission

(Continued from page 203)

make the steps between ratio changes greater and make power shifting more difficult. On the other hand, the ten speeds seem to be very satisfactory for all field work. The entire range of speeds can be moved up or down by changing the fixed ratio in the last planetary set. The low speeds have been a big advantage in power take-off work.

Summary

The purpose of this paper is to give a general overall picture of a new transmission. There are many specific characteristics and many development phases that have not been mentioned. Such problems as clutch clearance, facing material, clutch-engagement characteristics, material selection and heat-treat, torsional vibration, no-load friction, and oil specifications have not been discussed. Finally, the authors would say that the design specifications have been satisfied and that the tractor user will benefit in more work done and with less effort on the part of the operator.

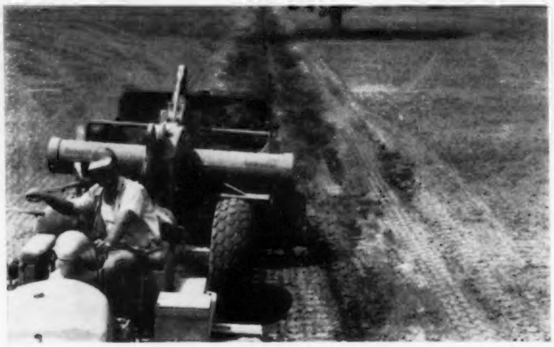


Fig. 1 Cutting flat sloped ditches with tractor and scraper for pasture land and utilizing earth for forming the area, Ben Hur, La.

Land Forming for Drainage

The practice of smoothing and shaping land to facilitate the removal of excess rainfall

Irwin L. Saveson
Fellow ASAE

THE presence of ponded water in pockets on land after heavy rains is indicative of an unsmooth surface which takes its toll in lowered crop production. The primary purpose of forming and smoothing land is to provide a uniform land surface that will facilitate an even movement of surface water over the entire fill. The practice was developed in the arid section of the United States to assist in the application of irrigation water, and it is moving to the humid section of the country to facilitate removal of excess rainfall by surface drainage, especially in Louisiana, where the annual rainfall is very high, ranging from 55 to 60 in.

Research work was started in Louisiana in 1946. This modification of land forming, called in the sugar-cane area "turtlebacking," is becoming more popular on sugar plantations.

Recently a modification of turtlebacking has been used in the cotton and general crop section of the Louisiana Delta. Under these conditions, it facilitates both the application and removal of surface water for irrigation and drainage. Agricultural workers have used the principles and techniques developed in the arid section of the United States in forming and smoothing land since there was little information available for the humid areas, but due to climate, crops, topography, and soils, have found it necessary to modify them to meet conditions of the humid area.

Preparation for Forming the Land

The idle period for cropland is also the wet season of the year, with the exception of sugar cane. Farmers are thus induced to try to form the land when it is wet, which in most instances damages the land. Experience has shown it to be more desirable to leave the land out of crops for a season, then forming it during dry periods after adequate disposal of crop residues. Considerable machine time and effort has been wasted in trying to form and smooth land under trashy conditions.

Paper presented at a meeting of the Southeast Section of the American Society of Agricultural Engineers at Birmingham, Ala., February, 1957.

The author—IRWIN L. SAVESON—is project administrator, soil and water conservation research division (ARS), U.S. Department of Agriculture.

The first step in preparing land for forming is to dispose of the crop residues by plowing them under, allowing sufficient time for them to decompose before starting the forming operations. In the meantime, volunteer vegetation is kept under control by disking. The area is generally floated or dragged to remove the rows and implement scars and to firm the area as much as possible.

Farming operations in disposing of trash and controlling vegetation leaves the earth in a fluffy condition. This must be considered in making the earth-moving calculations, since a fluffy soil condition in many instances lessens efficiency, for the reason that earth-moving equipment operates better on a firm than on a loosened soil.

Forming the Land

Land forming to improve drainage in Louisiana can be divided into three classes: sugar cane land, pasture land, and general cropland.

Sugar cane land is divided into cuts from 150 to 250 ft wide and approximately 1,000 ft long, bounded by a drainage ditch on each side and a headland across each end. The ditches and crop rows run parallel to the main slope of the land. A sugar cane cut is generally formed with the crown (not less than 0.3 per 100 ft) similar to a highway. Where there is side fall to the field, the cuts can be formed in a plane sloping from ditch to ditch. Since the sugar cane cut is narrow and the earth-moving distance is generally short, an experienced operator can generally grade them by eye with a few indicator points. Only a few differential levels need to be taken to establish these points. Bulldozers are the most efficient equipment in forming the land since the earth-moving distance is short. The first step is to move the earth deposited on the headlands by the implements leaving the ground to the depressions formed where the implements enter the ground. The earth along the ditches is moved towards the center of the cut and distributed to form the required shape. Normally there is sufficient earth for forming the sugar cane cuts, but, if not, additional earth is transported to the cut by scrapers from outlet channel spoil. After forming, the area is smoothed by a land leveler or motor grader. Differential levels are again taken after

Fig. 2 *(Left)* Smoothing pasture after cutting ditches and forming with land leveler and tractor • Fig. 3 *(Right)* Seeding pasture area after forming and smoothing, Ben Hur, La.

smoothing to check the adequacy of the forming. The cost of the work is approximately $45 per acre and in most instances the cost is liquidated by the increased crop yield (5.81 standard tons of cane) secured the first season after forming.

Pasture land is generally formed into beds or corrugations with a limited amount of surveying and staking. In most instances the beds or corrugations are approximately 60 ft wide. Each bed has a flat-sloped ditch (6:1) on each side which blends into the bed or the corrugations to facilitate mowing. The motor grader is used for cutting the ditches and casting the earth to the center to form the beds. In some instances where the topography is undulating, the motor grader is used as a dozer to move the earth into depressions. After forming, little smoothing is required since most of it is done during the forming operation. Costs on this type of work vary considerably and are reported from $15 to $60 per acre. There is very little data available on the increased benefits of forming pastures, but in most instances drainage is required to establish the pasture and landowners report an increased carrying capacity for formed pastures.

Fig. 4 Forming general cropland with tractor and scraper, Newellton, La.

The forming of general cropland requires more surveying and staking than sugar cane or pasture land since it consists of large areas. It will require a topographic map for earth-moving design and calculations. The topography of the area is mapped by using a grid-type survey. Stakes are set on 100-ft stations (grid corners). The staking is done by chaining a double base line in each direction across the field. Each double base line is perpendicular to the other. The other stakes for establishing the rest of the grid corners are located by sighting on each of the double base lines. Levels are taken to the closest 0.05 ft at each stake in reference to a bench mark.

Fig. 5 Forming sugar cane cut with bulldozer, Port Allen, La.

The level information is plotted on cross-section paper. In most instances it is desirable to sketch in the contours of the area on an interval of 0.2 ft. From the survey information the center point of the field, average elevation, and most suitable grade are determined for the area. The most suitable grade can be calculated by the method of least squares(5)*. For irregular-shaped areas the method is quite complicated, but it can be applied to the rectangular part of the area used as a guide to determine the most suit-

(Continued on page 213)

*Numbers in parentheses refer to the appended references.

Fig. 6. *(Right)* Smoothing sugar cane cut after forming with bull-dozer, Port Allen, La.

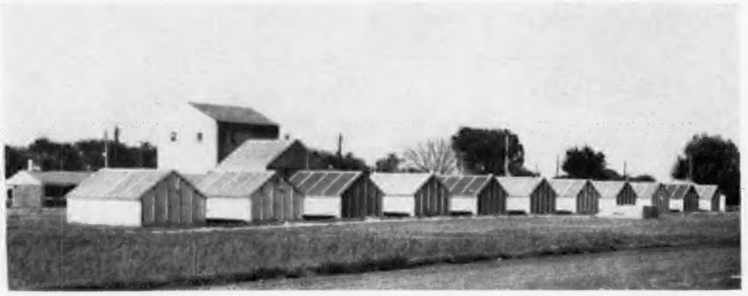


Fig. 1 Exterior view of 4-pen hog houses. Inner nine units were used for housing animals. Units at each end were for exposure control

Swine Growth and Efficiency . . .

in a Naturally Varying Environment

T. E. Hazen, N. H. Curry,
Assoc. Member ASAE Member ASAE
and H. Giese
Fellow ASAE

In the trend toward confinement-rearing systems, effects of environment on swine growth and feed efficiency must be determined before engineers can coordinate building design and capital investment

THE general hardiness of hogs and the larger areas required to house them under controlled conditions might appear to make confinement rearing systems both expensive and unnecessary. However, present data indicate that here is a phase of swine production where partial control can yield high returns. Much good work has been accomplished in the psychrometric laboratory (1)* at Davis, Calif., under controlled conditions with small numbers of animals. The work reported here extends this information to naturally varying environment within the growing-finishing stage.

Experimental Tests

Our experiments were designed with two major objectives: *(a)* to determine what measurable physical factors have the greatest influence on swine growth, and *(b)* to counteract economically, if possible, lack of proper environment with improved nutrition. Work to date has been primarily under objective *(a)* using rations prepared by the Swine Nutrition Section, Animal Husbandry Department, Iowa Agricultural Experiment Station. Rations, formulated on established nutritional needs according to animal weight, are given in Table 1.

Studies were conducted during the summer of 1955, 1956, and 1957, and during the winter of 1955-56. Physiological characteristics of swine indicated the most severe reaction to hot weather should occur with animals of 100 lb and over, and to cold weather with animals under 100 lb. Therefore, heavy pigs were used whenever possible in summer tests and light pigs in the winter test. Physical environment conditions within the houses were allowed to vary normally with outside weather for each test period. Uniformity in all management respects was practiced.

The nine windowless 4-pen houses (Figs. 1 and 2) were identical except for the covering material: three covered with aluminum, three with galvanized steel, and three with wood siding and asphalt shingle roof. Characteristics of these coverings indicated three levels of environment should be obtained.

Animal weight and feed consumed were recorded at two-week intervals during the first summer and winter tests but the programming was changed to weigh weekly during the second and third summer. It was found from the first summer test that animal and feed weights during the first two weeks of a test were inconsistent with following data, probably due to reacclimatization of the test animals. This

TABLE 1 – EXPERIMENTAL RATIONS

(14 percent protein used for young pigs in winter test and summer 1957. Otherwise 12 percent to 150 lb and 10 percent from 150 pounds to market weight)

Basal ration (including percent protein)	14 percent	12 percent	10 percent
Green yellow corn	79.8	85.6	91.05
Dehydrated alfalfa	2.5	2.5	2.5
Meat and bone scraps	2.5	2.5	2.5
Fish solubles	1.0	1.0	1.0
Soybean oil meal	12.0	6.5	1.0
Calcium carbonate	0.5	0.6	0.55
Dicalcium phosphate	1.0	0.6	0.7
Iodized salt	0.5	0.5	0.5
Trace minerals	0.05	0.05	0.05
Lederle 2-4-9C	0.05	0.05	0.05
Lederle aurofac 10	0.05	0.05	0.05
Lederle profactor B	0.05	0.05	0.05
Vitamin D_2 (142F)	0.25 gm/100	0.25 gm/100	0.25 gm/100

Paper presented at the Annual Meeting of the American Society of Agricultural Engineers at Santa Barbara, Calif., June 1958, on a program arranged by the Farm Structures Division and approved as Paper No. J-3508 of the Iowa Agricultural and Home Economics Experiment Station, Ames, Iowa. Project No. 1244.

The authors – T. E. Hazen, N. H. Curry and H. Giese – are, respectively, associate professor, professor, and professor of agricultural engineering, Iowa Agricultural Experiment Station.

Acknowledgment: The authors express their appreciation to the Reynolds Metal Co., Louisville, Ky., and Dr. Damon Catron and his staff of animal husbandry, Iowa State College, for their fine cooperation in this study.

*Numbers in parentheses refer to the appended references.

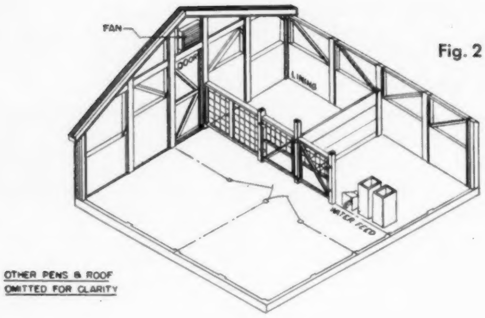
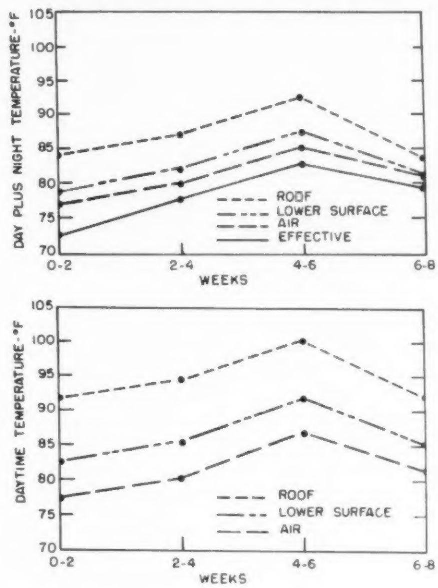


Fig. 2 Interior sketch of a 4-pen hog house

Fig. 3 Comparison of inside average temperature. Aluminum houses — summer 1955



meant that for an eight-week test period, only three points remained that could be used reliably to compare environmental factors with efficiency in growth. Weekly weighing, after permitting the elimination of data for the first week, produced seven points for comparison.

Thermocouples connected to a multipoint potentiometer were installed for continuous recording of air temperature, water temperature, and surface temperature of the covering materials. Hygrothermographs recorded relative humidity. A Hardy Dermal Radiometer was used for surveys of thermal radiation inside the houses. Additional instruments measured the solar radiation, outside air temperature and wind velocity. Most of these instruments were of the recording type.

Results

Data consistently showed that, of the measurements taken, average air temperature at the hog level for the test period was a good overall measure of environmental influence. Because air temperatures can be easily obtained and easily understood by swine producers, comparisons were, therefore, made with average (mean) temperature at the hog level. A summary of rate of gain, feed conversion, efficiency, and average air temperature at the hog level within each building type is presented in Table 2.

To justify use of air temperature as a base measurement, rate of gain and feed efficiency were also compared with measurements of equivalent radiant temperature (thermal radiation) and average effective saturated temperature (a measure of relative humidity and dry-bulb temperature) for the summer of 1955. Plots (Fig. 3) indicated the same general pattern as for average daily air temperature, suggesting the latter measurement to be a composite of these and other physical factors. Correlations designed to eliminate age and hereditary effects on these data confirmed this assumption. A low correlation was found between all measurements and feed efficiency. A highly significant correlation existed between average air temperature and daily gain. A lower correlation existed between average daily gain and other physical measurements. The correlation between daily gain and radiant temperature was only slightly less than significant, showing this to be the next largest single contributor. The coupling of a high correlation of temperature with daily gain and a low correlation with feed efficiency suggests that loss in production efficiency was largely the result of a reduction in appetite.

In summer tests, significant differences were found in both feed efficiency and average daily gain between animals

TABLE 2 — SUMMARY OF RESULTS
Breeding: Poland China × Landrace × Duroc
Design: Randomized block, 3 treatments with 3 houses per treatment.

Test period	House type	No. of animals	Avg initial weight, lb	Avg final weight, lb	Avg daily gain, lb	Avg lb feed per lb gain	Average temp., F
	Aluminum		114.1	217	1.82	3.85	80.8
Summer 1955	Steel	72	115.1	208.1	1.63	4.00	83.5
	Wood		112.4	206.5	1.70	3.95	82.4
	Aluminum		51.4	156.6	1.69	3.46	35.3
Winter 1955-56	Steel	144	51.4	157.3	1.71	3.46	35.8
	Wood		51.2	159.7	1.75	3.38	40.7
	Aluminum		108.9	210.3	1.79	3.92	80.6
Summer 1956	Steel	72	108.9	206.8	1.71	4.03	82.2
	Wood		109.4	216.2	1.86	3.96	80.4
	Aluminum		81.6	152.0	1.69	3.51	82.5
Summer 1957	Steel	108	82.7	149.0	1.60	3.47	84.8
	Wood		83.1	149.5	1.59	3.46	84.8

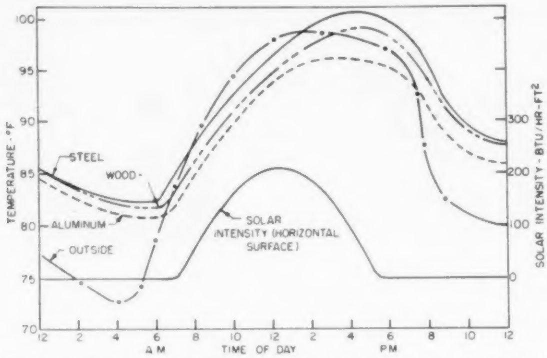


Fig. 4 Inside average air temperature by house type, outside air temperature, and solar intensity for July 30, 1955

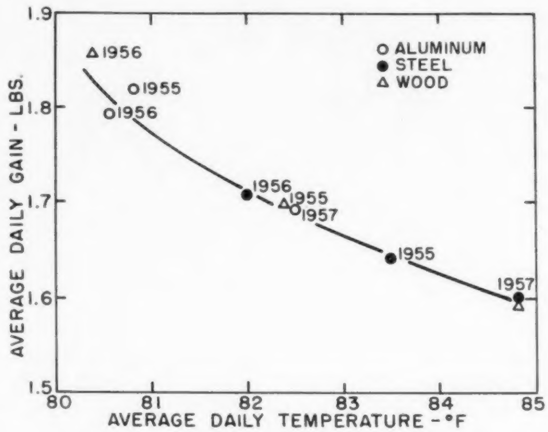


Fig. 5 Average of daily gains for all summer tests

housed in the aluminum units and those housed in the steel units where the temperatures were, respectively, the lowest and the highest. At first a little better agreement was obtained when comparing these data with that of the University of California if the average daytime air temperature (air temperature from sunup to sundown) was used. Some justification might be found for this in that the nighttime air temperatures were almost identical for all nine buildings (Fig. 4). Data obtained in 1956 and 1957 did not confirm this assumption, and in fact, indicated a more reliable agreement between average daily temperatures (where the nighttime temperatures were included) and animal response.

Time is a factor in thermal stress — if an extremely hot day is followed by a cool night, the overall effect is less than could be anticipated from average daytime temperature only. For example, the mean daytime temperature for the summer of 1956 was about the same as for 1955, with 1956 being characterized by short, frequent, hot spells with cool nights. In 1955, abnormally hot weather was confined to a continuous three-week period. The average daily temperature in 1956 was slightly cooler than in 1955.

Visual observations indicated that high-temperature stress must be prolonged for two or more days before there was loss in production efficiency. One day of high temperatures did not cause much change in activity or in feed consumed. Polypnea, with 180 respirations per minute, was common during the heat of the day when temperatures rose to between 95 and 105 F. Rates dropped to between 20 and 60 respirations per minute during the night. Since air velocity was confined to that necessary for odor and moisture removal — less than 100 fpm — little loss of heat could occur by convection. Hogs would wet their bodies with liquids from waterers and body wastes and lie prone during hot days. Practically all feeding was done at night.

In 1957, artificial heat was added equally to all buildings, elevating the mean air temperature at the hog level approximately 3 F. Again results of this study show an advantage for lower air temperatures.

Averaging the results of all three summers (Fig. 5), approximately an additional 0.05 lb of feed per lb of gain is required and a loss in rate of gain of approximately 0.05 lb per pig per day is obtained for every degree F of average daily temperature rise within the 80-85 deg range of these tests. Because of the narrow temperature range, projection of such data could be greatly in error — but the qualitative trend is definitely significant. It is entirely possible that changes in air motion and limited access to water for wetting the body surface could alter the apparent critical average temperature (in these tests found to be approximately 80 F) above which a marked reduction in production efficiency would occur.

Data for all three summers were combined for statistical analysis. Analysis of variance of average daily gain and feed efficiency and analysis of covariance of average daily gain and feed efficiency with average daily temperature were made. Statistical significance at the 5 percent level was found between both daily gain and feed efficiency and the average daily air temperature, with results favoring the lower temperatures obtained in the aluminum buildings. Statistical analysis again indicated that average daily air temperature at the hog level was an extremely good index of performance. When the temperature effect was removed, all replications showed nearly identical animal gain and feed efficiency. This suggests that further tests to determine animal response to environment can be based on average daily air temperature, independent of the enveloping material. In other words, by establishing the effect of a particular environment on growth, any building which provides this environment should result in equal animal response.

Data from the winter of 1955-56 showed an advantage in both feed efficiency and growth rate for the animals housed in the wood-covered units. Animals were bedded with straw but there was considerable huddling and shivering during the early part of the test. However, no indication of this apparent discomfort was evident in gains or feed conversion. Although average daily temperature differences between the wood- and metal-covered units were almost two and a half times (Table 2) that of the widest spread found in any of the three summer tests, there was not as great a difference in animal response. The aluminum and steel units, where almost identical temperature readings were recorded, showed almost identical animal response. The results of this winter study and those of the summer of 1957 involving animals of comparable weight showed reasonably good gains and feed efficiency for the weight range of animals involved. Neither test resulted in severe stress. These data also suggest that young growing-finishing

swine are less severely affected by cold weather — when protected from wind and wet — than heavier animals are by high temperatures.

An economic projection of the averaged results of the summer tests in terms of feed savings accompanying a slight decline in air temperature would represent an estimated $4 million annually per degree drop in Iowa alone. The difference between high and low groups obtained through a selection of skin materials of basically equal cost is of comparable economic magnitude with major nutritional advances. This provides an insight into what might be gained economically by wisely engineered design of controlled production units.

Summary of Findings

Average air temperature at the hog level is a reliable index of growth rate in growing-finishing swine produced in confinement. In the mean temperature range of 35-40 deg, young growing-finishing swine are not severely retarded when protected from wind and wet. Heavier swine (over 100 lb) raised in confinement showed a drop in daily gain and feed efficiency of 0.05 lb per day and 0.05 lb feed per lb gain respectively for each degree F of average temperature rise in the range of 80-85 F tested. Summer production rates with growing-finishing swine, in the range tested and under naturally varying conditions, are similar to those under constant temperature conditions when the average air temperature at the hog level is equal to that under the constant temperature condition.

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. . . Land Forming

(Continued from page 209)

able grade. This procedure will of course require some adjustment.

Some engineers use the contour map and establish the grade by inspection, later adjusting it to meet the cut-and-fill requirements for forming the area. After determining the grade, the cuts and fills are computed, making allowance for shrinkage. The term "shrinkage" refers to the settlement of an area by machines operating over it. For most fields the shrinkage varies from 0.04 to 0.10 ft.

The yardage to be moved is computed from the calculated cuts and fills. On an average field a 60:40 cut-fill ratio will balance the yardage; however, considerable experience in the area is required to estimate the proper cut and fill ratio. The cuts and fills are marked on the stakes. Generally the fill stakes are marked in blue and the cut stakes in red. A mark is placed on the side of the stake indicating the point of fill or cut. This mark is established by using a level and rod, the elevation being referenced to the previously established bench mark. Some operators prefer that the earth be removed around the cut stake and the actual point of cut marked. Others prefer to have the stakes marked a constant height above the points in order to clear the surface of the ground. Where the earth is firm and the levels were taken at each stake the cuts and fills can be established by measuring from the ground surface; however, it is more desirable to establish them by rod and level from a bench mark.

Before starting earth-moving, it is desirable to prepare a sketch map showing the cut and fill areas and the movement of the earth. This is of considerable help to the operator, in many instances saving a considerable amount of machine time. Scrapers are generally used to form the land after the cut and fill stakes are set. The areas are worked in lanes and the stakes are left on islands until the forming work is completed. Most of the forming work should be done within 0.05 ft. After forming, the stakes are removed and the area is then smoothed with a land leveler, which will remove the islands left after the forming operations, correcting in most instances any discrepancies beyond the 0.05 ft tolerance allowed for forming operations. The area is then checked for agreement between final grade and planned grade. A number of different types of earth-moving scrapers, land levelers, etc., are being offered in the delta section of Louisiana. Most of them are doing a good job if they are operated by an experienced operator and are properly adjusted.

In the delta section of the state, soil moisture and texture are not uniform thus complicating the earth-moving operation. In the cut areas, scrapers are difficult to hold, in many instances overcutting, which necessitates refilling the area. The moist areas are rubbery. In the smoothing operation the land levelers with cross blades often only depress the high points without removing them, leaving a knoll which interferes with the movement of water. There is need for some machine development work to correct this situation.

There is a wide variation in the amount of yardage required to form Louisiana delta lands. It ranges from 125 to 450 cu yd per acre. Average haul distance is approximately 400 ft. In some instances it is 1,000 ft, but this is uncommon. The cost of grading ranges from 18 to 25¢ per yard, with the higher cost being on areas with light cuts and fills.

Ripping the area after smoothing to remove the compaction caused by the earth-moving machines is desirable. These machines increase the bulk density of the fill areas by approximately 0.10 grams per centimeter (approximately 6¼ lb per cu ft). It is also desirable to rip the area for blending of the fill with the original soil and thus lessen the crop retardation in the fill areas. A heavy field cultivator with flexible chisel shanks is a good tool for this operation.

No definite research results are available on the amount of increased yields to be expected by forming general cropland since it is difficult to install a field experiment that can be analyzed statistically. Where yield records are available, there has been a definite trend to even up the production over the entire fields.

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Streambank Stabilization

Leon F. Silberberger

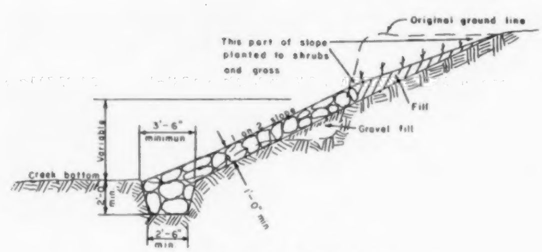

Fig. 1 Typical riprap section

Use of rock revetment for bank protection in combination with vegetation as an engineering material

THE major streambank control measures that have been used on the Buffalo Creek flood prevention project during the past ten years are discussed in this paper.

The U.S. Department of Agriculture undertook a detailed survey of the flood and erosion conditions on Buffalo Creek Watershed in 1938 under the authority of the Flood Control Act of 1936. The survey appraised the nature and extent of damage from floods, erosion, and sediment. On the basis of this survey, a watershed improvement program was developed including soil and water conservation on all watershed lands and treatment of submarginal lands recommended for non-federal public purchase. The recommended program was approved by the 78th Congress, Public Law 534, December 22, 1944. Specific approval for the streambank stabilization work was approved by an amendment in 1946. The Secretary of Agriculture assigned responsibilities for installing this work to the Soil Conservation Service.

Buffalo Creek is approximately 50 miles long and drains an area of 437 square miles including 21 square miles in the City of Buffalo where the creek drains into Lake Erie. The two main tributaries are Cazenovia Creek and Cayuga Creek.

Approximately 80 percent of the basin is in the upland region of the Allegheny plateau. The remaining 20 percent is in the Ontario lowlands on the lake plain. The elevation ranges from 571 ft above sea level at Lake Erie to 1940 ft in the hilly region in the southeastern portion of the watershed.

Soils in the watershed range from well-drained glacial till and outwash soils, which favor rapid absorption, to permanently wet glacial till soils which have little capacity for infiltration. The watershed has a fairly uniform average precipitation throughout the year ranging from 30 to 36 in. The rainfall is greater in the headwaters than at lower elevations.

Floods may occur on the watershed at any season. Records show, however, that most of the floods occur in the spring and are caused by rapid thawing of snow cover alone or in combination with rainfall. Ice jams at bends and in constricted reaches cause overland flooding both above and below the jams. Overbank flooding in the spring seldom lasts more than one or two days. Floods in the summer are caused by excessive or prolonged rainfall when infiltration is inadequate to reduce runoff to channel capacities. Summer floods are usually out of banks only a few hours.

The main justification for the streambank control program is based on sedimentation damages in Buffalo Harbor. Records of maintenance dredging costs indicated average annual figures in excess of $150,000.

The major sources of erosion in the watershed are streambank erosion and sheet erosion. A review report prepared by the Soil Conservation Service in 1955 indicated that 53 percent of the sediment entering Buffalo Harbor originated from streambank erosion and 47 percent from sheet erosion.

Streambank-control operations were started in the fall of 1949. Over thirty miles of stream channel has received bank stabilization measures, and approximately twenty miles remain to be completed.

Easements and rights of way for installation of streambank control measures are provided by the joint board of the Erie and Wyoming soil conservation districts.

This paper will review the major streambank stabilization measures which appear to be working successfully on the Buffalo Creek project.

Rock revetment is the principal type of bank protection that has been used. This method consists of streambank sloping and the placement of a heavy rock toe at the base of the slope and rock riprap on the slope. The eroding banks are first sloped to a 2-to-1 slope. A heavy rock toe is placed in a trench excavated to a minimum of 2 ft below existing stream channel bottom. The bottom of this toe trench follows the talweg profile (line joining points of greatest depth in successive cross sections). This heavy toe insures stability of the riprap by preventing undercutting of the bank. Experience has shown that the stream cuts deeper next to the base of the riprap on concave bends. Riprap is placed against the slope from the toe up to a line which approximates the annual flood height (Fig. 1). Factors influencing the design height of the riprap in addition to the annual flood were degree of curvature of the bends, erodibility of the bank material, and the importance of the bank segment being stabilized to the total stream reach being protected. The bank area above the riprap is planted with vegetation.

The major portion of the riprap has been "machine placed" and includes a small amount of hand work. A

Paper presented at the winter meeting of the American Society of Agricultural Engineers at Chicago, Ill., December, 1958, on a program arranged by the Soil and Water Division.

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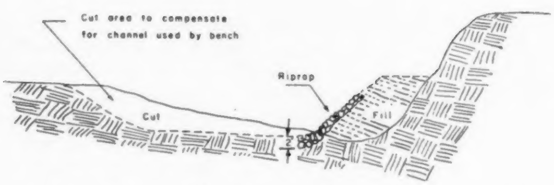

Fig. 2 Embankment bench method of protecting high banks

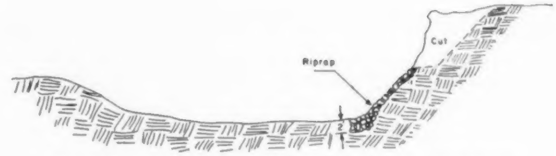

Fig. 3 Excavated bench method of protecting high banks

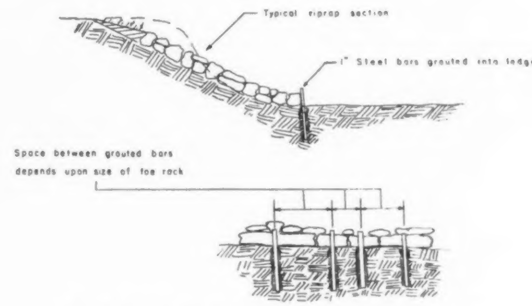

Fig. 4 Stabilizing toe rock with grouted steel bars

power crane equipped with a clamshell bucket has been found by contractors to be well adapted to this work. The clamshell bucket will handle quarry run rock very effectively. It enables the operators to sort the rock which is delivered to the site by truck. The larger rock is taken from the dumped piles first and placed in the toe trench. The remaining rock is then picked up and grades well into a 12-in. layer of riprap. The fines or small rock particles are dumped on the rock layer last and help chink the rock layer into place.

The toe trench is excavated by the power crane equipped with the clamshell bucket. This enables the machine to dig and fill the toe trench with rock as it proceeds along the bank. A skilled operator can be expected to place well over 100 lineal feet of toe trench and riprap bank averaging 150 sq yd in an 8-hr day.

The major part of the bank sloping has been accomplished with the power crane equipped with dragline bucket. The machine is operated close to the bank and moves parallel to the bank. The bucket is dragged diagonally across the bank in the sloping operation.

A different approach has been used for placing riprap revetment in the protection of high eroding banks. Many eroding banks in the Buffalo Creek watershed exceed 60 ft in height. Obviously it would not be practical to slope banks of this size. Two methods have been used in the case of high banks—the embankment-bench method (Fig. 2) and the excavated-bench method (Fig. 3).

The embankment bench method includes the placement of a gravel bench along the base of the eroding bank. The elevation of the bench is set not lower than the height of the opposite bank and, where practicable, 1 to 2 ft higher. This gravel bench provides drainage at the base of the bank and a stable fill to support the riprap. It provides a working space for the power crane and a storage area for riprap stone.

The use of the embankment bench requires that the convex side (low bank) of the channel be excavated to compensate for the reduction in area taken by the bench projection. The high bank is left to slough down on the prepared bench until it has established a slope that is stable enough to be planted.

The excavated bench method is used in similar situations to the embankment bench. This method neither requires the securing of gravel fill material nor the enlarging of the channel to compensate for a jutting bench as in the latter case. This method would not be used where the conformation of the bank was such that it required unreasonable quantities of excavation to form the bench. It also requires an area suitable for spoiling the excavated material.

The decision as to which one of the two bench methods to use was based on the inherent adaptability of each method, the accessibility of the area to equipment, and the availability of gravel materials. The gravel bench is vulnerable to flood damage during construction until the riprap is in place. Both methods have been equally effective after installation.

Diversion ditches have been used above the high bank to divert surface water runoff where conditions were such that these flows would erode the bench. The flow from springs in these banks has been controlled by piping the flow directly into the stream channel.

Experience on Buffalo Creek has not indicated the need for a gravel blanket under the riprap except where bank material is fine glacial till or clay. The quarry-run limestone rock used for riprap is well graded so that sufficient fines (spalls) are available to lay a very compact revetment. The riprap has few openings which expose the bank material to erosion. The majority of the embankment slopes are made with gravel from the stream and therefore provide an ideal base for the riprap.

Lengthy segments of the channels in the middle and lower reaches of Buffalo Creek have beds of shale. This condition presented the problem of how to tie the toe of the riprap to the bed. The movement of ice and debris in addition to the forces of the flood flows against these banks makes the toe section particularly vulnerable to damage. The toe of the riprap, like the foundation of a building, must be stable if the revetment structure is to remain effective. The toe is subject to the forces of the flood water and the debris that it carries. The debris coming from the watershed during one of the storms was so heavy that boats were held out of Buffalo Harbor until the debris mass could pass out into the lake.

Several methods of stabilizing the toe section of the riprap to the shale bed of stream have been used. These include excavating the toe using pneumatic chippers, blasting a toe section using a poured concrete curb, and building up an extra large toe section with stone.

It should be pointed out that the shale bed, while it is very stable, does erode at varying degrees depending upon its structure. In some segments of the channel, the shale

. . . Streambank Stabilization

breaks up into small flakes when it is exposed to the air while in other segments of the channel it is very stable. For this reason, it was necessary to devise some type of toe anchor that would remain effective under the eroding bed conditions. Two methods are presently being used to accomplish this. One method used is No. 8 steel reinforcing rods, 3 ft in length, grouted in drilled holes, approximately 2 ft in depth. The use of this method required that the large stones be placed along the outer edge of the toe and that the rods be placed at random in position against the rocks that appeared to be the key stones (Fig. 4). An inspection of banks where these rods have been used has indicated the magnitude of the forces which occur when flood-borne materials strike the base of bank work. A recent inspection of work where rods had been installed showed that many of the rods were bent as much as 45 deg from their vertical position.

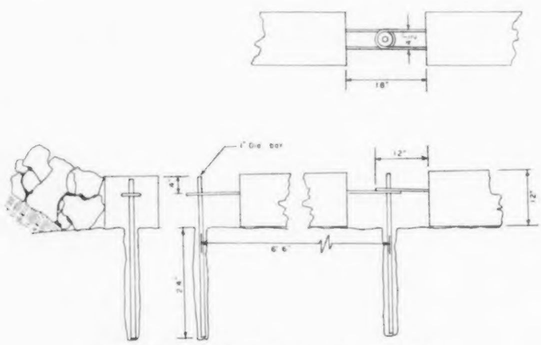

Fig. 5 Installation of concrete toe blocks

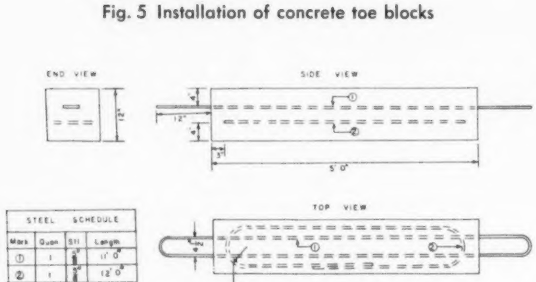

Fig. 6 Detail of precast concrete footer

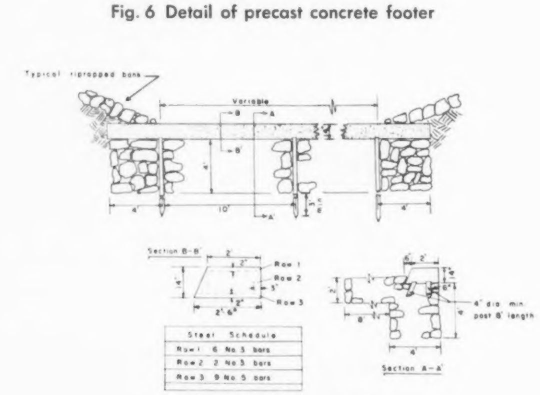

Fig. 7 Grade control sill

The other method now being used to hold the toe section in place is through the use of precast concrete blocks. The present design (Figs. 5 and 6) consists of a precast block, 12 in. square and 5 ft long. Reinforcing steel loops protrude from each end of the block for a distance of 12 in. These steel loops are utilized in handling the blocks using a two-hook sling from a power crane. No. 8 steel reinforcing rods 3 ft long are placed in drilled holes in the rock bed and grouted in place on 6 ft 6 in. centers. The precast blocks are placed into position by the power crane so that the steel loops fit over the grouted bars. Succeeding blocks are placed so that the end loops overlap over the bars. In places where the channel bed was uneven, the steel loops were bent as the blocks were placed so that they hooked to the vertical bars. In placing the riprap stone, a wood plank was placed over the section of concrete blocks so that stones that dropped from the bucket against the block did not cause damage. It can be seen that these toe blocks are quite flexible, being free to settle should the bed erode and shift within the loop space along either axis of the block.

Channel cutoffs have been used in a few instances where the cost of cutting a new channel and protecting with riprap has been less or no greater than protecting the existing channel and where the use of the cutoff will improve the hydraulic characteristics of the stream. Thorough study of channel cutoffs is necessary due to the increase in channel slope that occurs due to shortening of the channel reach. In order to control possible degradation that might take place where channel changes were made, cross stabilizers or sills were used (Fig. 7). The use of these sills can best be illustrated by describing one of the more intensive installations where they were used.

The cutoff known as the "Earsing Job" was one of the larger cutoffs on the Buffalo Creek Project. This job involved cutting through a large oxbow to give better channel alignment so that more permanent protection from the riprap revetment might be secured. The original channel was 4680 ft in length with grade of 0.00111. The cut-off channel was 2300 ft with grade of 0.00222. The channel section used was a trapezoidal section with a 130-ft base width. Five sills were installed (Fig. 7). The distances between the sills, the top of each being installed at channel grade, are No. 1 to No. 2, 403 ft; No. 2 to No. 3, 334 ft; No. 3 to No. 4, 403 ft; and No. 4 to No. 5, 396 ft. This work was installed in 1955, and several large floods have passed through the channel. The sills have not required maintenance and appear to be controlling the channel slope satisfactorily since no unusual degradation has taken place during the three years they have been in use.

Although the greater part of the structural program was concerned with the protection of the streambank against forces within the channel, an important part of the work involved the handling of surface water flows which would pass over the streambank into the stream. This drainage, unless controlled, would soon cause gullies to form and aggravate the control problems. Regular drop structures of concrete were used where large off-stream flows entered the streams. Water from small drainage areas was handled satisfactorily by carrying the riprap to the top of the banks and warping it into the side channel so as to form a chute to carry the water into the stream. This method of handling the overbank flows has held up well and required very little maintenance.

The basic control method, as previously mentioned, involves the sloping of the bank, the construction of a toe, and the placement of riprap approximately half way up the bank. The remainder of the bank is planted to grass and woody vegetation. This vegetative material is now being considered as an integral part of the engineering design. The vegetative program shows great promise of successfully reveting the upper portion of many of the banks. This program, due to the protection it affords on a cost per square yard basis, fits well into the channel program. The channel control methods used on the Buffalo Creek Project involve the coordination of the structural and vegetative methods. The need for careful planning by the engineer in the use of vegetation was found to be an absolute necessity, and its importance to the success of the channel control work cannot be overemphasized.

In addition to the establishment of vegetation on the streambank, a vegetative cover was also established on areas disturbed by construction operations along the top of the bank and adjoining areas. This work was found to be particularly important on banks which were subject to overbank flows.

In the design of the channel protection work when using vegetation as one of the "engineering materials," it is important that the engineer keep in mind that the planned use of vegetation presupposes the ability to have it when and where it is needed. It was found that several steps had to be taken to insure the establishment of the vegetation. Steps that have lessened the risk of failures in the vegetation program are as follows:

1 The stockpiling of top soil or fine soil material during the channel excavation work so that it may be used for grading over the slopes where the banks are mainly composed of coarse gravel and cobbles.

2 The use of mulch on new seedings. Wood chips from clearing operations have proved to be a very good mulching material.

3 The application of heavy fertilizer treatment. This treatment to include a top dressing of nitrogen (ammonium nitrate) after plant growth is out of ground.

4 The use of irrigation equipment for applying water when needed.

5 The protection of seedings and plantings from livestock.

Successful vegetative cover now being used is made up of two grass mixtures, one of tall fescue, ryegrass, and crown vetch, and the other of red fescue, ryegrass, and bird's foot trefoil. The ryegrass is added to the mixtures in small amounts to help insure quick cover. Seeded areas are later planted to purple osier willows.

It should be pointed out that one of the most important things that has been fairly well determined on Buffalo Creek, from the engineers' points of view, is the limitation of the vegetative program. It must not be used on areas where the forces acting on it are so great that it cannot be established or maintained.

The streambank installations which have been reviewed have been subjected to several floods well above the magnitude of the average annual flood during the past five years. These installations have been effective in withstanding these floods but not without some required maintenance. The joint board of the Erie and Wyoming soil conservation districts is responsible for the maintenance of the streambank work. They have expended approximately $15,000 on repair during the past five-year period. This systematic maintenance of the revetment work is a prime necessity in channel work.

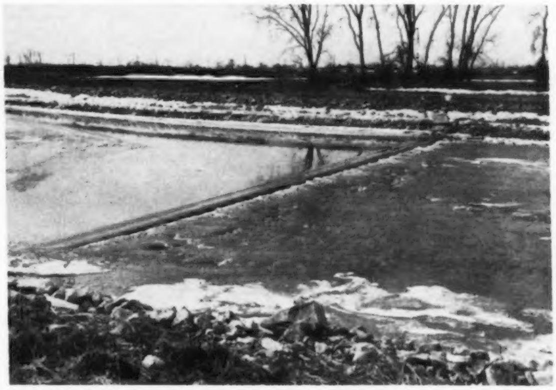

Fig. 8 Grade control sill on "Earsing job" in Buffalo Creek

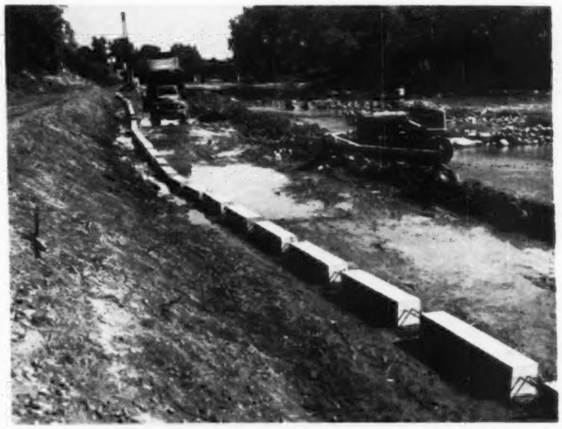

Fig. 9 Precast concrete toe blocks in position prior to placement of rock riprap on sloped bank

Fig. 10 Precast concrete toe blocks in place on Buffalo Creek. Note grouted steel dowel

INSTRUMENT NEWS

Air-Flow Measurement in Crop Driers

F. H. Buelow
Member ASAE

THE low velocities of air flow encountered in grain and hay drying cannot be measured accurately, if at all, with conventional instruments because of the small pressure drop permissible across the meter. MacDonald and Hedlin(1)* proposed a meter based on the hot wire anemometer principle which will measure air flow rates below 20 cfm/sq ft without appreciable pressure drop.

Where only an occasional reading is required, a more simple and less expensive measuring device would seem desirable. Such a device is shown in Fig. 1 and consists of a 4½-in. diameter plastic pipe 40 in. long, and a toy balloon. The only other equipment needed to measure air velocity is a stop watch. The plastic pipe is marked in 1-ft intervals, with the zero-foot mark being about 1 in. from the bottom.

The device is intended for measuring upward air flow at the top surface of grain or hay. With appropriate elbows and connections, air flow in other directions could also be measured. The procedure for measuring the air-flow rate is to first set the plastic pipe on the surface of the grain or hay at the point at which the measurement is to be made. The balloon is then inflated to a size which will drop slowly through the tube while the drier is in operation. Normally it is desirable to leave the balloon in the tube for some time so the temperature of the air in the balloon is the same as that of the air passing through the tube. Thus, any errors due to balloon expansion or contraction are minimized. When the balloon is at the same temperature as the air in the tube, its rate of fall through the tube is recorded first with the drying fan in operation and then with the pipe set on paper or solid surface to close the bottom. The air flow rate through the grain at the point measured is simply the difference between the two falling rates of the balloon, which usually have the dimensions of feet per minute.

That the air-flow rate is equal to the difference in the two falling rates can be shown as follows. The weight of the balloon, the diameter of the pipe, the diameter of the balloon, and therefore the area of the opening between the balloon and the pipe are all constant during any test. As a result the balloon drops at a constant rate, and a constant flow of air passes by it because all the factors remain constant. To determine what this rate of passage is, it is necessary to measure the falling rate with no air entering or leaving the pipe. The falling rate is then equal to an air velocity, V_1, through the pipe which will just suspend the balloon. If the upward air velocity, V_2, is less than the suspension velocity, V_1, the balloon will drop at a rate, V_3, equal to the difference in the two velocities, or $V_1 - V_2 = V_3$. Thus, the upward flow rate of air V_2, is simply the difference between the two falling rates, $V_2 = V_1 - V_3$, both of which can be measured.

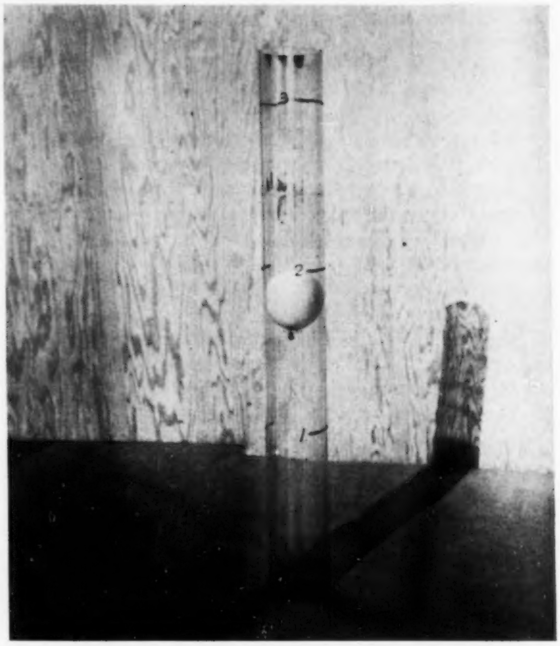

Fig. 1 A plastic pipe and toy balloon provide simple device for measuring air flow during grain and hay drying

The accuracy of measurement of the air-flow rate increases as the air-flow rate decreases since the falling rate can be determined more accurately. Several trials will also increase the accuracy of the readings. If height is not a limitation, a longer pipe could also be used to increase accuracy.

The pressure drop across the test apparatus was measured and found to be about 0.006 in. of water with a paper clip used to seal the balloon. Errors due to this pressure drop are negligible.

It was found that the balloon would "chatter" during its fall if the pipe was not vertical or if the balloon was too eccentric. Although the falling rate did not seem to change with the "chatter," it does not seem desirable, and should be eliminated if possible to be sure of the most accurate measurements.

Reference

1 MacDonald, J. B. and Hedlin, C. P. Air-flow meter for crop drier. AGRICULTURAL ENGINEERING 35(9):658-659, September 1954.

An Instrument News Contribution. Articles on agricultural applications of instruments and controls and related problems are invited by the ASAE Committee on Instrumentation and Controls, and should be submitted direct to Karl H. Norris, instrument news editor, 105A South Wing, Administration Bldg., Plant Industry Station, Beltsville, Md. Paper is approved for publication as Journal Article No. 2337 of the Michigan Agricultural Experiment Station.

The author – F. H. BUELOW – is assistant professor of agricultural engineering, Michigan State University, East Lansing, Mich.

*Numbers in parentheses refer to appended references.

1959 ASAE 52nd Annual Meeting, June 21-24
Cornell University, Ithaca, New York

Riley-Robb Hall on the Cornell University campus in Ithaca, New York, will serve as headquarters for the 52nd annual meeting of ASAE, June 21-24

INVITATION

For the first time in ASAE history, Cornell University is privileged to serve as host at the annual summer meeting. We extend a cordial invitation to all ASAE members and friends to come to our campus, "far above Cayuga's waters", and share with us the technical sessions, traditions, and entertainment associated with the yearly convention.

Sincerely,

O. C. French

(Above) O. C. French, head of agricultural engineering department, Cornell University, personalizes an invitation to attend the Society's 52nd Annual Meeting

(Right) University dorms, available for housing to ASAE visitors, overlook beautiful Lake Cayuga and the surrounding Finger Lakes countryside

Annual Meeting Preview

The 52nd Annual Meeting of ASAE will be held June 21-24 at the New York State College of Agriculture on the Cornell University campus in Ithaca – the heart of the famous Finger Lakes vacation spot and one of the nation's leading dairy areas. Cornell engineers have planned a daily series of entertainment and tours in addition to the technical program.

Indians from New York State will be featured in entertainment Sunday night, June 21, in a program of Indian costume and lore set up by Dr. E. A. Bates, advisor of Indian Extension. Monday evening a chicken barbeque will be held at Taughannock Falls – the highest waterfall east of the Rockies – with hiking trails, swimming, boating, and fishing facilities, and an unequalled view. ASAE President E. G. McKibben will play host at a party Wednesday evening when features will include a talk by Dr. Karl Butler, farm counselor, Avco Mfg. Corp., on his travels in Russia last summer and musical entertainment by male quartets and a chorus of some 60 voices.

Tours on Tuesday afternoon, June 23, will include the Corning Glass Center, home of the world-famed Steuben Glass; the Morse Chain Company, which plays a large part in the production of agricultural machinery and equipment; and the well-known Ithaca Gun Company.

For additional private trips in the area, the Cornell men recommend the Farmers' Museum at Cooperstown, showplace of old-time farm equipment, and the Jackson and Perkin's Rose Gardens at Newark where the annual Rose Festival will be underway.

For more on where to go and what to see, write to the Travel Bureau, State Department of Commerce, 112 State St., Albany 7, N. Y.

A review of the technical program gives promise of a most informative meeting. On Monday, June 22, five concurrent sessions will be held in both the morning and afternoon, and again on Tuesday morning, June 23. Special features planned for Tuesday afternoon include the tours, the Public Lands and Public Works Joint meeting with the Irrigation and Drainage group, and the FEI Student Dinner.

On Wednesday morning, June 24, four concurrent sessions will be held. In the afternoon a general session will precede the annual business meeting, to be followed by special entertainment and presentations of awards.

Extension Seminar

An Extension Seminar will be held Thursday, June 25, at 8:30 a.m. Some of the topics to be discussed at this session include: challenges facing extension engineers, industry extension programs, purposes and methods of in-service training of county agents, and effective county agent training. A get-acquainted luncheon will be held Thursday noon.

Student Program

E. G. McKibben, director, AERD, ARS, USDA, and ASAE president, will address the students during the Student Program Monday morning, June 22. Tuesday morning, June 23, J. L. Butt, ASAE executive secretary, will give an annual report from ASAE headquarters on student branch affairs and Ralph A. Palmer will be moderator for a panel discussion on interpretations, experiences and problems in the organization and operation of student branches. There will be tours in the afternoon and an FEI dinner for students Tuesday evening. Included in the afternoon session will be a review of the 1959 FEI trophies competition, by D. H. Daubert, and the election of National Council officers. A general session will be held on Wednesday afternoon.

Advance registration cards and hotel reservation forms will be mailed to ASAE members soon. Non-members interested in attending the meeting should communicate with the central office of the Society at St. Joseph, Mich., for information on accommodations and the program of the meeting sessions.

ASAE Officers for 1959-60

The following new officers of the American Society of Agricultural Engineers were elected as a result of the regular election conducted by letter ballot of its corporate members, and will take office at the close of the Society's annual meeting to be held on the campus of Cornell University, June 21-24:

President — L. H. Skromme, chief engineer, New Holland Machine Division of the Sperry Rand Corp., New Holland, Pa.

President-Elect—Lloyd W. Hurlbut, chairman, agricultural engineering department, University of Nebraska.

Vice-President — E. W. Schroeder, head, agricultural engineering department, Oklahoma State University.

Councilor — A. W. Cooper, (AERD, ARS), USDA, Tillage Machinery Laboratory, Auburn, Ala.

Nominating Committee — R. K. Frevert (chairman), director, agricultural experiment station, and professor of agricultural engineering, University of Arizona; R. E. Stewart, professor, agricultural engineering, University of Missouri; C. S. Morrison, manager, product development department, Deere & Co., Moline, Ill.; Nolan Mitchell, vice-president and director of sales, Aerovent Fan & Equipment, Inc., Lansing, Mich., and George E. Spencer, head, agricultural engineering department, Purdue University.

At the time the newly-elected officers take office the Council will be increased from 9 to 10 members and will consist of the following: E. G. McKibben and Earl D. Anderson, past-presidents; J. W. Borden and W. J. Ridout, Jr., vice-presidents; and H. H. Nuernberger and G. E. Henderson, councilors.

Members of the Society are invited to send to any member of the Nominating Committee such suggestions as they may have for nominees for election of officers of the Society in the next annual election of officers which will be held early in 1960. It is desirable that such suggestions reach the Nominating Committee on or before June 1, 1959.

Details for Annual Meeting Extension Exhibits

The Extension Committee is planning to make the ASAE 52nd Annual Meeting to be held June 21-24 at Cornell University, outstanding with respect to exhibits.

The exhibit classes include publications, demonstration models, movies, radio and television, slides and film strips, extension methods or recipes, and textbooks. Blue ribbons will be awarded winners in all classes except textbooks. Industry groups will not compete against the public agency groups and vice versa.

Publications: Included in this entry will be bulletins and periodicals and these will be separated into industrial and public agency classes. Each ASAE member may enter one bulletin and/or one periodical. Write for an application blank to Donald W. Derber, agricultural extension section, U.S. Steel Corp., 2831-525 William Penn Pl., Pittsburgh 30, Pa.

Demonstration models are to "show developments having engineering implications relating to agriculture, the primary objective of which is the education of the viewer." Classes will be provided for public agency and industrial groups. Rules and regulations for entry of demonstration models may be obtained from W. Everett Eakin, farm promotion manager, Libbey-Owens-Ford Glass Co., 608 Madison Ave., Toledo 3, Ohio.

Movie awards will be made in two classes, those prepared by industrial or commercial organizations, and those developed by colleges, universities and other public agency groups. Any group or any individual who has developed a movie during the past year is eligible to enter competition for this blue ribbon by writing B. P. Hess, Westinghouse Electric Corp., Dept. 10-L, East Pittsburgh, Pa.

Radio and TV Exhibits: Any charts, photographs, slides and other specimen used in the preparation of television and radio materials that might make interesting exhibits for ASAE can be entered by writing for an application form from Donald Brown, extension agricultural engineer, Michigan State University, East Lansing.

ASAE student member, Marvis N. Gillum *(left)* judged outstanding student in agricultural engineering at the University of Missouri, receives 1959 Sophomore Award from Harold Patrick, president, University of Missouri Student Branch of ASAE. The award, an engineering handbook, was presented at the annual Engineering Convocation, one of the major events of Engineers Week at the University, and is based on scholarship, character, leadership, and participation in activities of the student branch

Slides and Film Strips are some of the most effective teaching aids in extension programs. A set of slides or film strips showing agricultural engineering developments or how to teach some phase of agricultural engineering may be submitted. There are two classes, one for industrial and commercial groups and one for the public agency group. For applications on slides and film strips write to R. O. Gilden, extension agricultural engineer, Federal Extension Service, USDA, Washington 25, D.C.

Extension Methods and Recipes: This phase of the exhibits gives the extension agricultural engineer an opportunity to swap ideas on how best to carry out certain jobs connected with his work. Write Leo T. Wendling, extension agricultural engineer, Kansas State College, Manhattan, for an application.

Textbooks are not judged or ribbons awarded but it provides an opportunity to see what is new in the textbooks field and also gives the authors and publishers an opportunity to display their publications. If any new textbooks have been produced during this year the committee would like to have them entered. Applications may be obtained from J. P. Schaenzer, 1116 S. 28th St., Arlington 6, Va.

Societies Merge

Word has been received that the American Society of Heating and Air-Conditioning Engineers has merged recently with the American Society of Refrigerating Engineers to form the new society of the American Society of Heating, Refrigerating and Air-Conditioning Engineers. New officers elected are as follows: President, Cecil Boling, W. Hartford, Conn.; 1st vice-president, A. J. Hess, Los Angeles, Calif.; 2nd vice-president, D. D. Wile, Los Angeles, Calif.; 3rd vice-president, W. A. Grant, Syracuse, N. Y.; 4th vice-president, R. H. Tull, Springfield, Mass.; 5th vice-president, John Everetts, Jr., Philadelphia, Pa.; 1st treasurer, J. H. Fox, Toronto, Ont., Canada; 2nd treasurer, F. Y. Carter, Detroit, Mich.

The consolidated society will have a membership of more than 18,000. A. V. Hutchinson will serve as executive secretary and offices will be maintained at 62 Worth St. and at 234 Fifth Ave. in New York City.

EVENTS CALENDAR

April 23-24—*41st Annual Meeting of American Zinc Institute, Inc.,* Drake Hotel, Chicago, Ill. For additional information write to American Zinc Institute, Inc., 324 Ferry St., Lafayette, Ind.

May 1 — *Annual Conference for Engineers and Architects,* College of Engineering, The Ohio State University. Contact Harold A. Bolz, Dean, College of Engineering, OSU, Columbus 10, Ohio, for information.

April 29—May 1 — *Metals Engineering Conference* of the *American Society of Mechanical Engineers,* Albany, N. Y. For details contact L. S. Dennegar, Director of Public Relations, ASME, 29 West 39th St., New York 18, N. Y.

May 3-10 — *Soil Stewardship Week,* sponsored by the *National Assn. of Soil Conservation Districts.* For material write to Nolen J. Fugua, President, NASCD, P.O. Box 7, Duncan, Okla.

May 5-7 — *14th Purdue Industrial Waste Conference,* Purdue University. For details write Don E. Bloodgood, Purdue University, School of Civil Engineering, Lafayette, Ind.

May 7-9 — *First World Congress for Agronomic Research,* Headquarters of the FAO, Rome, Italy. Organized by the International Confederation of Agricultural Engineers and Technicians. For details contact The CITA Secretary's office, (1st World Congress of Agricultural Research), Beethovenstrasse 24, Zurich, Switzerland.

May 11-12—*Triennial Technical Conference* of the *U.S. National Committee* of the *International Commission on Irrigation and Drainage,* Reno, Nev. Information may be obtained from Stephen H. Poe, Executive Secretary, U.S. National Committee, ICID, Box 7826, Denver 15, Colo.

Hawaii Section

The Hawaii Section met Friday, March 20, in the Princess Kaiulani Hotel for a dinner meeting at which they discussed expansion of membership and organization of the program for the year. Plans were made for a future tour of the Hawaii Meat Co. to observe feed lot operations. A dinner will be held following the tour.

New officers for 1959 are Roy Tribble, chairman; Harry Cerny, vice-chairman in charge of promotion; Bill Hart, vice-chairman in charge of program, and Jaw-kai Wang, secretary-treasurer.

Quad City Section

The Quad City Section will hold its Annual Meeting on April 24, at the Moline American Legion Hall, 1623 15th St., Moline, Ill. The program will be preceded by a tour of Rock Island Arsenal shops and laboratories and a presentation on the development of new products and processes at the Rock Island arsenal, by Commanding Officer Colonel Daniel L. Hine. Following a 6:30 p.m. dinner, W. J. Adams, Jr., assistant manager of Central Engineering, Food Machinery and Chemical Corp., will discuss steering and traction characteristics of rubber-tired and crawler vehicles. The business meeting and annual election of officers will follow.

Florida Section

The Florida Section will hold its sixth Annual Meeting April 17-18 at Hotel George Washington, West Palm Beach. The story of Florida's Everglades will be given during the morning session by W. T. Forsee, Jr., chemist in charge, Everglades Experiment Station. H. A. Hooks, general manager, Florida Citrus Commission, will discuss Florida citrus fruits. A tour of the Everglades agricultural area with M. H. Byrom and D. S. Harrison as guides will follow the two presentations. L. E. Oglesby, International Harvester Co., will serve as toastmaster for the annual dinner at which E. G. McKibben, director, AERD, ARS, USDA and president of ASAE will present "Challenges to Agricultural Engineers."

At the Saturday morning session, agricultural engineering in Florida will be discussed by D. T. Kinard, head, agricultural engineering department, University of Florida; Florida's agriculture and some related agricultural engineering problems will be presented by Thomas J. Hughes, agricultural news editor, Florida Grower and Rancher; low cost plastic liners for mole drains, will be described by Luther C. Hammond, associate professor of soils, University of Florida, and Fred Laswell, inventor, cartoonist and writer of Snuffy Smith, will talk on mechanical harvesting of citrus.

Connecticut Valley Section

The Connecticut Valley Section met at Publick House in Sturbridge for their February 11 meeting. Maurice Burgener, manager of the Farm Bureau of the Portland Cement Association, Chicago, and speaker for the meeting, discussed new developments in farm construction. Joel Clayton of Amherst, section chairman, was in charge.

A meeting was also held April 1 on the campus of the University of Massachusetts, Amherst. The afternoon was spent touring agricultural engineering activities in Massachusetts. During the evening meeting a panel discussion was presented on the field relationships among agricultural engineers in public service, private practice and commercial employment.

Southwest Section

The annual meeting of the Southwest Section was held at Adolphus Hotel in Dallas, Texas, March 12-13, with 120 members in attendance. Three sessions during the 2-day meeting devoted one-half day to each of the following subjects of vital importance to the Southwest: (1) Irrigation Water Management, (2) Materials Handling, and (3) Environmental Control.

J. L. Butt, ASAE executive secretary, impressed the members by an enumeration of services received for their ASAE dollar in a talk given preceding the business session.

At the business meeting, members voted to make a special assessment of $2.00 per member to raise the Southwest Section's share of the Motion Picture Fund.

New officers elected during the business meeting include: J. W. McTaggart, farm field engineer for Portland Cement Association, chairman; J. L. Gattis, agricultural engineer for the Arkansas Agricultural Extension Service, vice-chairman, and E. D. Wilborn, associate editor of The Progressive Farmer, secretary.

ASAE MEETINGS CALENDAR

April 16-18 — FLORIDA SECTION, George Washington Hotel, West Palm Beach, Fla.

April 23-24 — ALABAMA SECTION, Anniston, Ala.

April 24 — QUAD CITY SECTION, Moline American Legion Hall, 1623 15th St., Moline, Ill.

JUNE 21-24 — 52ND ANNUAL MEETING, Cornell University, Ithaca, N. Y.

September 1-3 — NORTH ATLANTIC SECTION, University of Maryland, College Park, Md.

October 14-17 — PACIFIC NORTHWEST SECTION, Ephrata, Wash.

October 21-22 — Alabama Section, Enterprise, Ala.

December 16-18 — WINTER MEETING, Palmer House, Chicago, Ill.

NOTE: Information on the above meetings, including copies of programs, etc., will be sent on request to ASAE, St. Joseph, Mich.

South Carolina Section

The South Carolina Section published its first issue of "The South Carolina Agricultural Engineer," the new Section newsletter. A minimum of two issues each year is planned by Section officials. They also announce plans for a summer meeting to be held late in August at Camp Bob Cooper near Summerton, being planned as a family outing to be enjoyed along with meeting routine.

Southeast Section

The Southeast Section met February 2-4 at the King Cotton Hotel in Memphis, Tenn., with 140 agricultural engineers from 12 southern states present. In his talk on world challenge to agricultural engineers, Dr. E. G. McKibben, ASAE president and director of the agricultural engineering research division of the USDA at Beltsville, Md., described projects he visited in European countries while attending the Fifth International Congress of Agricultural Engineering. F. B. Lanham, head, agricultural engineering department at the University of Illinois, discussed the education program for professional agricultural engineers in our day. At the final meeting, J. D. Johnson of Louisiana State University dis-

(Continued on page 224)

(Above) **New ASAE Southwest Section officers are *(left to right)* W. H. Carter, past-chairman; E. D. Wilborn, secretary; J. L. Gattis, vice-chairman; and J. W. McTaggart, chairman**

(Right) **New officers for North Carolina Section are *(left to right)* William H. Johnson, secretary-treasurer; Jan van Schilfgaarde, first vice-chairman; and Robert W. Wilson, chairman**


W. Sivyer


M. O. Whithed


T. E. Long


A. M. Lane


C. J. Steinbrunner


H. A. Cloud


J. F. Schrunk


F. C. Miner

William Sivyer, former central regional sales manager of Chain Belt Co., has been promoted to manager of the Conveyor and Processing Equipment Division. He had served the company in his former post since 1957.

M. O. Whithed has been appointed rural service manager of the Edison Electric Institute. He was formerly rural service supervisor for Atlantic City Electric Co. where he had been employed for 24 years. While serving with Atlantic City Electric he also was engaged in EEI activities. He is a past chairman of the EEI Farm Utilization Committee and in 1957-58 served as chairman of the EEI Farm Group. He was graduated from Powers Institute, Bernardston, Mass., in 1929, and from Bliss Electrical School, Washington, D.C., in 1931. He is a member of the Farm Electrification Council of New Jersey, the Jersey Agricultural Society, and has been a member of ASAE since 1947.

Thomas E. Long, former assistant to the vice-president for promotion, has been appointed eastern regional manager of the Portland Cement Association effective March 15. In his new position he will supervise the association's field activities in eleven states from the regional office in New York City.

A. M. Lane, who has been employed as general sales manager of Mobile Hydraulics Division of Vickers Incorporated, Detroit, Mich., has been appointed commercial markets development manager for the company. He has been with the company in various sales and engineering assignments since 1940.

C. J. Steinbrunner has been promoted to the newly created position of director of product planning and improvement with the New Idea Farm Equipment Co., Coldwater, Ohio. In his new capacity he will serve as chairman of the product committee. In April he will complete 41 years of service with the company.

Harold A. Cloud has been chosen for the position of assistant managing director of the American Concrete Pressure Pipe Association. He was formerly employed as a research engineer for the Minneapolis Honeywell Regulator Co. For six years previous to this he was a member of the University of Minnesota agricultural engineering staff.

John F. Schrunk, vice-president of American Portable Irrigation Co. of Pompton Lakes, N. J., has been announced as presently assigned to special national and international projects in the interest of the company. **Frank C. Miner,** former manager of Farm Improvement Co. of Denver, it was also announced, has been elected a vice-president of American Portable Irrigation Co. and will work on special sales assignments.

Jack D. Traywick, who has returned from a two-year assignment as American advisor in Peru from North Carolina State College, has accepted a post as research instructor in forage preservation at North Carolina State College.

Ernest W. Walpole has been promoted to manager of Masonite Corporation's agriculture department. He joined the company in 1957 as assistant manager. He is a graduate of Ontario Agricultural College and has an M.S. degree from Iowa State College. He taught agricultural engineering courses at the Ontario Agricultural College and designed and promoted farm structures with Weyerhaeuser Sales Co. As assistant manager of the Masonite agriculture department, he was responsible for the technical direction of the factory-built farm building program.

Jay G. Porterfield, professor of agricultural engineering, Oklahoma State University, is on sabbatical leave from Oklahoma State University, beginning February 1, 1959, and continuing until January 31, 1960. He has been awarded a National Science Foundation, Science Teacher Fellowship for the purpose of research, teaching and study at the University of Melbourne, Victoria, Australia.

Mason Vaugh, life member of ASAE and retired head of agricultural engineering at Allahabad Agricultural Institute, Allahabad, India, was one of the four prominent American engineers and alumni of the University of Missouri to receive the Missouri Honor Award for Distinguished Service in Engineering from the university's College of Engineering and Engineering Foundation. He was cited "In recognition of his outstanding career as a pioneer agricultural engineer and educator in India; his training and encouragement of students, his promotion of systems of adult education, his voluminous writings on the applications of engineering to problems in Indian agriculture; his unselfish service on numerous educational and agricultural boards and agencies of the Indian government; his energy, vision and leadership in the design and manufacture of labor-saving implements and machines especially suited to the needs of Indian agriculture."

NECROLOGY

E. D. Knight, president of Virginia Electric Co. of Charleston, West Virginia, one of the largest wholesale electrical supply centers in West Virginia, died of pneumonia Thursday, January 8, 1959. He was born March 23, 1894 in Charleston, W. Va., and was educated in the Charleston public schools, Manlius School, Manlius, N. Y. and at Dartmouth College from where he received an A.B. degree in advanced mathematics and preliminary engineering in 1916. He began his career as an electrical apprentice and mine electrician with the Cabin Creek Consolidated Coal Co., Kayford, W. Va., in 1916 and the following year became chief electrician. In 1922 he accepted a position as vice-president and chief engineer of the Virginia Electric Inc. and in 1930 he was promoted to president of the company, a position he held until his death.


E. D. Knight

He was a member and trustee of the Kanawha Presbyterian Church, the Charleston Chamber of Commerce, Kappa Kappa Fraternity, Edgewood Country Club, Dartmouth College Club of New York and the Rolling Rock Club of Ligonier, Pa. He was a member of the State Soil Conservation Committee, former president of the West Virginia Forest Council, and a registered professional engineer. He is survived by his wife, Lucille, and a son E. D. Knight, Jr. He became a member of ASAE in 1947.

TEAR OUT AND PUNCH AS INDICATED FOR YOUR FILE

. . . Section News

(Continued from page 221)

cussed contract farming as a suggestion of how agricultural engineers might meet farmers needs for new equipment. The session was closed with a summary of the work being done by the National Society of ASAE by Executive Secretary J. L. Butt from Society Headquarters in St. Joseph, Mich.

New officers for the Southeast Section are: J. M. Myers, University of Florida, chairman; A. W. Snell, Clemson College, first vice-chairman, and J. K. Jones, National Cotton Council at Memphis, secretary and treasurer.

North Carolina Section

Members of the North Carolina Section met on March 6 to attend their winter meeting at the agricultural engineering department on the campus of North Carolina State College in Raleigh. A presentation on agricultural engineering in Russia by Carl Hall from Michigan State University was featured during the one-day meeting as well as a stimulating talk by E. G. McKibben, ASAE national president. The program was rounded out by presentations on selection of motors and controls for materials handling systems, by Julian Lynch, design engineer, Westinghouse Electric Corp.; water requirements of growing plants, by Jan van Schilfgaarde, agricultural engineering department, North Carolina State College; new tobacco harvester, by R. W. Wilson, agricultural engineer, R. H. Bouligny, Inc., and recent developments in peanut harvesting and curing research, by W. T. Mills and J. W. Dickens, agricultural engineering department, North Carolina State College.

New officers of the Southeast Section were selected during February meeting in Memphis, Tenn. Seated, left to right, are A. W. Snell, 1st vice-chairman; Dr. E. G. McKibben, president of ASAE; and Tom E. Corley, out-going chairman. Standing, left to right, are J. K. Jones, secretary-treasurer; J. L. Butt, executive secretary of ASAE; and Blaine F. Parker, 2nd vice-chairman. J. M. Myers, new section chairman was not present when photo was taken

New officers for the coming year were elected as follows: chairman, R. W. Wilson; first vice-chairman, Jan van Schilfgaarde; second vice-chairman, Elijah Tyson, and secretary-treasurer, W. H. Johnson.

Many of the members took advantage of the opportunity to attend the Farm Electrification Symposium which was held on March 5 and which was co-sponsored by the North Carolina Section of ASAE. The purpose of the symposium was to "chart a new mission for electricity." ASAE members who participated are: G. W. Giles, head, department of agricultural engineering, North Carolina State College; H. B. Puckett, agricultural engineer, USDA, University of Illinois; F. H. Buelow, agricultural engineering department, Michigan State University, and K. H. Norris, agricultural engineer, USDA, Beltsville, Md.

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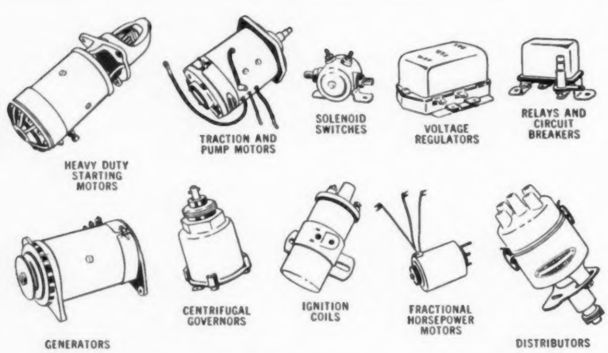
LIGHT, QUIET, RUGGED ADVANCE DESIGN STARTING MOTORS

NEW COST REDUCTION SERVICE FOR MANUFACTURER CUSTOMERS

Programs that include design, engineering, methods, automation and manufacturing are all contributing to the important new cost reduction service of the Electrical Products Group of Auto-Lite. Included are greatly expanded research and engineering activity, facilities for field training and servicing and District Managers prepared to assist customers and prospects in their drive for lower costs.



Here is a starting motor built to *your* design. Auto-Lite talked with engineers throughout the country before designing this motor. Then we designed in those features that you wanted most.

LIGHTNESS ... The use of a new concept in frame construction makes this motor lighter than former designs, yet just as sturdy.

QUIETNESS . . . A shunt coil mounted with three series coils limits light load speed and improves pinion to ring gear meshing. This quiets the motor and extends gear life.

RUGGEDNESS . . . This design has survived rugged tests of heat, freezing, high impact, current overload, humidity, and dust. Long term, harsh endurance tests were run; 40,000 to 50,000 starts . . . the equivalent of 12 years or more of normal service.

Radical brush rigging minimizes arcing at the commutator and cuts current loss, due to dust grounding, to a negligible factor. And this new 12-volt model comes with either a positive shift or a Bendix drive . . . covers a wide variety of applications.

AUTO-LITE®

ELECTRICAL PRODUCTS GROUP

THE ELECTRIC AUTO-LITE COMPANY, TOLEDO 1, OHIO

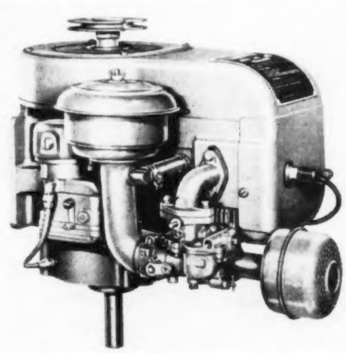
Flail-Type Harvester Shredder

New Idea Farm Equipment Co., Coldwater, Ohio, announces a new flail-type harvester-shredder which has a 70-in. cut and can be used for a variety of farming operations. As a forage harvester, it will cut, chop and load fresh or wilted hay in one operation. It also chops and loads straw or cornstalks for stover and bedding and picks up and loads windrowed crops without special attachments. An adjustable-spout

deflector is controlled from the tractor seat. Other uses include shredding stalks, clipping pastures, devining potatoes and topping beets. A lever adjusts from wagon loading to ground discharge without removing the hood. Each of the 30 cutting hammers are of high-carbon steel and one-piece construction. Cutting height can be varied from ground level to 12 in. by a hand lift or hydraulic cylinder. The machine has three quickly changeable positions—pull behind, offset, or transport.

Claims Largest Vertical Shaft Engine

Wisconsin Motor Corp., Milwaukee, Wis., announces a new heavy-duty, air-cooled vertical shaft engine, said to be the



largest engine of this type ever offered for original equipment applications. Designated as the Model HAENL, this engine will operate within a power and speed range from 4.7 hp at 1600 rpm to 9.2 hp at 3600 rpm. It has a piston displacement of 23 cu. in. (3 in. bore x 3¼ in. stroke) and is designed for low-silhouette, compact installations. A unique feature of the lubrication system is the mounting of the oil pump directly on the vertical crankshaft. A rotating vane-impeller, keyed to the crankshaft, delivers oil under constant pressure to a jet which directs a continuous spray of oil to the connecting rod and the tapered roller main bearings.

Hydraulic Power Package

Wooster Div., Borg-Warner Corp., Wooster, Ohio, has announced a line of low-cost, self-contained, versatile power

packages producing hydraulic power from an electric source. The package incorporates an electric motor, hydraulic gear pump with integral relief valve, check valve and reservoir in one compact assembly. The package is designed to handle work loads such as those encountered in heavy equipment as snow plows, tailgate loaders, tractors and lift trucks. The capacity of the gear pump ranges from 0.36 to 0.80 gpm.

One-Side Air-Mist Sprayer

The Oliver Corp., 400 W. Madison St., Chicago, Ill., announces a new one-side air mist sprayer, Model 919, which has a de-

livery range of at least 60 ft and head rotation of 210 deg. The sprayer is available as a complete unit or as an attachment adaptable to most steel or wood tank sprayers having 20-gpm or more capacity and a 300-gal or larger tank. Wide rotation of spray head reportedly provides uniform coverage in cross-wind applications. Adjustable vanes direct air to provide desired coverage in varying slope of land and crop conditions. Twenty-four hollow cone nozzles and nine blank tips are furnished to provide a wide variety of discharge rates. The sprayer is powered with a 36-hp engine which is direct connected to an 8-blade, 29-in. diameter vane-axial fan. The spray head is manipulated with either manual or 8-in. standard hydraulic cylinder controls.

New Five-Plow Tractor

Massey-Ferguson, Ltd., 915 W. King St. W., Toronto, Ontario, Canada, has announced a new five-plow tractor (M-F 85)

with a capacity rating of 60 hp. Shown is the high-clearance model. A new transmission offers 8 forward and 2 reverse speeds, ranging from just over one mph to approximately 20 mph. Power steering is standard equipment. Seat location, positioned forward of the rear axle for maximum comfort and visibility, is adjustable to accommodate tall or short operators.

(Continued on page 228)

. . . New Products

(Continued from page 227)

Agricultural Sprinkler

The Skinner Irrigation Co., 1201 Water St., Troy, Ohio, announces addition of the S-500 to its line of agricultural sprinklers.

The new sprinkler is designed to perform within a pressure and gallonage range of 10 to 60 psi and 1.0 to 10.8 gpm. It is an impact type, single-nozzle sprinkler and provides a choice in its design of a high or low-angle arc for permitting increased or decreased coverage with the same nozzle size and pressure. A bearing is recessed into the body of the sprinkler to give protection against blowing sand. The sprinkler also has a low center of gravity and a long leverage driving arm, said to improve operation at low pressures. The new unit is available in four models, all constructed entirely of brass and stainless steel, with a wide choice of nozzle sizes.

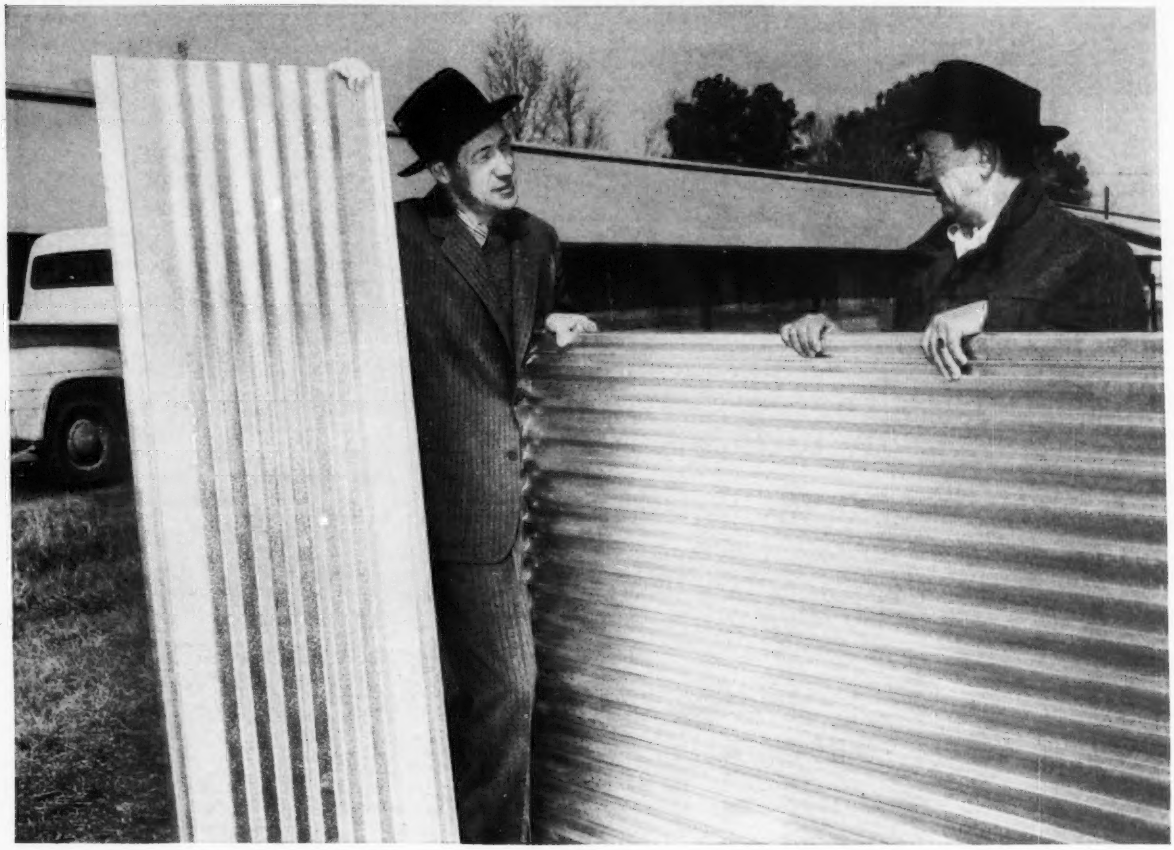
Rear-Mounted Drill Planter

Allis-Chalmers Mfg. Co., Milwaukee, Wis., announces new 2 and 4-row rear-mounted drill planters with new fertilizer

side-band placement disk openers designed for accurate placing of fertilizer below and to one side of the seed. These planters eject each seed individually for accurate spacing in the row. A screw crank regulates planting depth and close-coupled gage wheels assure uniform depth control. Row spacings range from 28 to 42 inches. Over 100 different seed plates are available to plant a variety of cultivated crops. Extra equipment includes 120-lb capacity, low-set fertilizer hoppers of fiberglass reinforced plastic construction. The hoppers are translucent and the fertilizer level can be checked from the tractor seat.

Molded Foam for Cushions or Insulation

National Aniline Div., Allied Chemical Corp., 40 Rector St., New York 6, N. Y., announces fully molded urethane foam cushions of high-tear resistance for tractor and other seating. The new cushions, called Permathane, can be molded into a variety of shapes, styles or designs. The manufacturer reports that the material shows unusual resistance against extreme heat or cold and can withtand excessive wear. It can be used with or without covering. In addition to seating, urethane has practical application for insulating refrigerated truck trailers, it is said. *(Continued on page 237)*



MANUFACTURERS' LITERATURE

Literature listed below may be obtained by writing the manufacturer.

Bulk Milk Cooler Bulletin

Sunset Equipment Company, P.O. Box 3536, St. Paul 1, Minn. — Bulk milk cooler specifications and details are covered in this new 4-page, 2-color brochure, with drawings and charts to show dimensions and capacities for each of the three designs and 11 models in the Sunset line. The milk cooler design and engineering features are also discussed with "on-the-farm" photos showing typical milk cooler and compressor installations.

Spray Nozzle Catalog

Wm. Steinen Mfg. Co., Industrial Nozzle Div., 43 Bruen St., Newark, N. J. — A new 32-page catalog with listings and data on all types of nozzles for spray applications, including specific data on spray nozzles, dimensions, types of connections, and capacity vs. pressure for all standard nozzles.

Metal Castings Answer Book

Dayton Malleable Iron Co., Dept. P., P.O. Box 980, Dayton 1, Ohio — This 30-page, 2-color folder points out in quick question-and-answer form, advantages and uses of malleable iron, pearlitic malleable iron, gray iron, aluminum and magnesium and typical applications. It is prepared as a reference for metal parts manufacturers.

Agricultural Leaders Kit

Kaiser Aluminum Agricultural Research Service, Farm Bldg. Plans Div., 1924 Broadway, Oakland 12, Calif. — This kit contains folders on the company's Diamond Rib roofing and siding and Roll-On roofing and siding, plans for a typical livestock range shelter, and a 14-page bulletin, "101 Ideas for Better Living with Kaiser Aluminum."

Hydraulic Data for Designers

Commercial Shearing & Stamping Co., Youngstown 1, Ohio — Bulletin 100-P3 is a 4-page publication which pictures each type of fluid-power component, describes features, and includes tables of design and application data. It covers dimensions, pressures, and input and output of motors and pumps; pressure drop tables and dimensions for control valves; and size, displacement, and effective area table for single-acting, double-acting, and telescopic cylinders. The publication also pictures and describes several fluid-power applications.

Steel Castings

Steel Founders' Society of America, 606 Terminal Tower, Cleveland 13, Ohio — This 6-page folder, Product Design Studies No. 89, describes and illustrates benefits derived from the use of steel castings relative to dependability and economy. It also describes requirements of steam turbine nozzle boxes obtained with cast steel structures.

Plastic Dispersant for Concrete

Acorn Paint & Chemical Co., 8001 Franklin Blvd., Cleveland 2, Ohio — A 4-page folder describing with photo illustrations the qualities of the company's concrete binder, Acronite B & B, used to replace water in mixing concrete. It is said to be successful for use on any type of floor or masonry surface for resurfacing or restoring and is described as being waterproof, permanent, and ready for use in eight hours after application.

Brush Clearing Implement

Taskers of Andover Ltd., Hants, England — Publication No. 1207, a 4-page folder describes and illustrates a rotary slasher, used for reclaiming land overgrown with scrub, weeds and thistles. It is said to be especially useful for plantations, drainage schemes, marginal land reclamations, airfield and roadside maintenance, and agricultural and industrial projects. Also included is Publication No. 117713, a 1-page leaflet picturing and describing Taskers' agricultural trailers and implements.

Welding Nut Uses

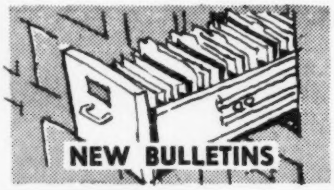
Midland-Ross Corp., Owosso Division, Owosso, Mich. — A 4-page booklet gives detailed description of Midland welding nuts and applications. Concluding paragraphs describe special machines with automatic feeds, available for application of nuts.

Hinged Pan Conveyors

Anchor Steel and Conveyor Co., 6906 Kingsley, Dearborn, Mich. — A 4-page Bulletin, No. 58-1, which describes the application of hinged pan conveyors in quench tanks, scrap movement, foundries, food processing and machined part handling. Detail drawings of hinged pans and photographs illustrate various existing installations of hinged pan conveyors used to move a wide range of material sizes and weights.

Free Plowing Analysis

Lantz Manufacturing Co., Valparaiso, Ind. — A questionnaire to be filled out by the farmer and returned to Lantz Mfg. Co. The company's engineers will answer the farmer's plowing problems and return the questionnaire to him.



The following bulletins have been released recently. Copies may be obtained by writing to author or institution listed with each.

Measurement of Quality in Foods and Agricultural Commodities by Physical Methods, by K. H. Norris, Reprinted from Proceedings of the First Symposium on Food Physics, August 1956. Write to K. H. Norris, Marketing Research Division, U.S. Department of Agriculture, Beltsville, Md.

New Trends in the Farm Shop, by D. W. Works and E. H. Davis. Leaflet No. 42, June 1958. University of Idaho, College of Agriculture, Extension Division, Moscow, Idaho.

Forces that Affect the Stability of a Tractor, by D. L. King, Technical Publication No. 16, October 1957. For copies write to Canterbury Agricultural College, University of New Zealand, Christchurch, New Zealand.

Determining the Drillability of Fertilizers, by C. W. Gantt, W. C. Hulburt, H. F. Rapp and J. O. Hardesty. Production Research Report No. 17, July 1958. United States Department of Agriculture, Agricultural Research Service, Washington, D. C. Copies for sale by the Superintendent of Documents, U.S. Government Printing Office, Washington 25, D.C. Price 15 cents.

Bin Pallets for Agricultural Products, by T. B. Heebink. Report No. 2115, June 1958. Forest Products Laboratory, Madison 5, Wis.

Washington Farm Electrification Committee Progress Report, 1957, by W. E. Matson, J. Roberts and E. L. Preedy, January 3, 1958. University of Idaho, College of Agriculture, Extension Division, Moscow, Idaho.

Arizona Loses a Water Supply (supplement to the booklet), June 20, 1958. For additional information write to G. E. P. Smith, College of Agriculture, University of Arizona, Tucson, Ariz. Price 80 cents.

Housing and Equipment for Growing and Finishing Hogs, by D. G. Jedele, Circular 799, July 1958. University of Illinois, College of Agriculture, Urbana, Ill.

Performance of Forage Crushers, by P. J. Zachariah, K. C. Elliott and R. A. Phillips. Bulletin 418, June 1958. West Virginia University, Agricultural Experiment Station, Morgantown, West Virginia.

Photoelectric Inspector Detects Green Rot in Eggs, by K. H. Norris. Reprinted from Electronics, July 1955. For additional information write to K. H. Norris, Marketing Research Division, U.S. Department of Agriculture, Beltsville, Md.

Looking Inside Fruit, by G. S. Birth. Reprinted from Agricultural Marketing, February 1957. Agricultural Marketing Service, U.S. Department of Agriculture, Washington, D. C.

Power Requirements of Tillage Implements, by W. J. Promersberger and G. L. Pratt. Bulletin No. 415 (Tech), June 1958. North Dakota Agricultural Experiment Station, Fargo, N. Dak.

Save Money—Water—Soil with Minimum Tillage, by R. L. Cook, H. F. McColly, L. S. Robertson and C. M. Hansen. Extension Bulletin 352, August 1958. Michigan State University, Cooperative Extension Service, East Lansing, Mich.

Bibliography on Electric and Related Equipment for Livestock Production and Feeding, ARS 42-22, August 1958. United States Department of Agriculture, Agricultural Research Service, Washington, D. C.

Agricultural and Horticultural Engineering Abstracts, Vol. IX, No. 3, 1958. For details write to W. H. Cashmore, Director, National Institute of Agricultural Engineering, Wrest Park, Silsoe, Bedfordshire, England.

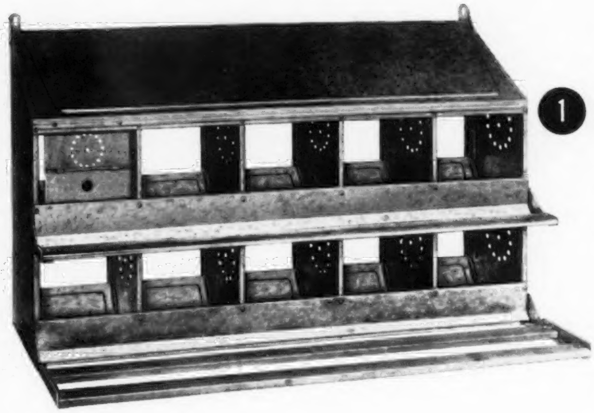
Mow Drying Hay With Tiered Air Ducts, by W. L. Kjelgaard. Progress Report 194, July 1958. The Pennsylvania State University, College of Agriculture, Agricultural Experiment Station, University Park, Pa.

Is Batch Hay Drying With Heated Air for You? by J. A. McCurdy and W. L. Kjelgaard. Special Circular No. 43. The Pennsylvania State University, College of Agriculture, Agricultural Experiment Station, University Park, Pa.

Water in the Santa Cruz Valley, by H. C. Schwalen and R. J. Shaw. Bulletin 288, Mailing Bureau, University of Arizona, Tucson, Arizona. Price $2.00.

Flow Properties of Bulk Solids, by A. W. Jenike, P. J. Elsey and R. H. Woolley. Bulletin No. 95 of the Utah Engineering Experiment Station, Salt Lake City, Utah. Price $1.50.

Here's how Armco ZINCGRIP Steel meets exacting design requirements



1

When you design with Armco ZINCGRIP® Steel, you can choose a special grade to meet your exact requirements.

For example, parts for the hen nest (Photo 1) required sharp bends. Armco ZINCGRIP Steel Lock-Forming Quality met this special need.

On the other hand, parts for the feeder (Photo 2) called for deep draws, so Armco ZINCGRIP Steel Drawing Quality was specified. Neither of these special qualities was needed to fabricate the trough waterer (Photo 3), so it was made of Armco ZINCGRIP Steel Commercial Quality.

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Regardless of the special forming qualities needed to meet your design requirements, you can be sure of having the finest in zinc-protected steel by specifying any Armco ZINCGRIP grade. All are made by a continuous patented hot-dip process pioneered and perfected by Armco Research.

The zinc coating doesn't flake or peel during fabrication. In fact, it withstands as much forming as the base metal. The full commercial weight zinc coating provides excellent protection against corrosion for all types of livestock and poultry feeders, waterers, nests, brooders, and other barnyard equipment.

For complete information on all grades of Armco ZINCGRIP Steel, just fill in and mail the coupon. If you have a specific problem, our metallurgists will gladly consult with you.

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3

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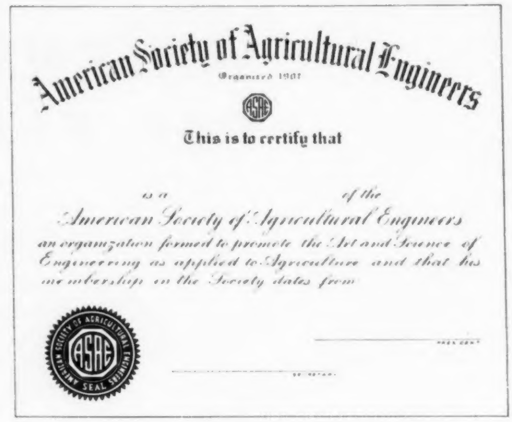
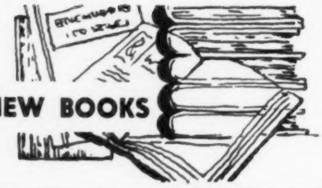


The official ASAE Membership Certificate, available to ASAE members only, measures 10¾ by 14 inches. It is engraved on heavy parchment paper and is suitable for framing. The member's name, grade of membership, and month and year of admission to the Society are engrossed by hand. The certificate is signed by the President and Secretary and bears the official (gold) seal of the Society. The price of the certificate, including engrossing, is $3.00. Order direct from

AMERICAN SOCIETY OF AGRICULTURAL ENGINEERS
P.O. Box 229, St. Joseph, Michigan



Farm Mechanics Text and Handbook, 1959 edition, by Lloyd J. Phipps, H. F. McColly, L. L. Scranton and G. C. Cook. Cloth, 6½ x 8¼ inches, 814 pages, indexed and illustrated. Published by The Interstate Printers and Publishers, 19-27 North Jackson St., Danville, Ill. $6.00.

This book is designed for use in courses for all-day, young farmer and adult farmer classes in farm mechanics, for courses in training teachers in farm mechanics, for farmers, for members of farm youth organizations, and for others interested in farm mechanics. Sections include instruction in shop tools and equipment, woodwork and farm carpentry, painting, refinishing and glazing, welding, hot and cold metal work, sheet metal work, rope and leather work, farm motors, trucks and tractors, transmission of power, farm machinery, farm buildings, concrete work, farm home conveniences and sanitation, fencing, rural electrification and soil and water management.

Investigation of Winding and Friction Forces on Material Contacting Rotating Shafts and Other Rotating Parts, (German) by Dr. F. Wieneke.

A study, based on a thesis by the author, who, in co-operation with the agricultural engineering department at the Hochwchule Braunchweig, explains the phenomena of winding occurring on rotating shafts and other rotating machine parts if contacted by material such as straw, hay, fiber, leaves and others. The paper gives a detailed theoretical and experimental report of the investigation of such forces involved in winding at wet and dry friction conditions and when mechanical pickup is experienced. It also describes the experimental test setup necessary to obtain measurements of these forces as they might be encountered in the field application on balers, binders, combines and others.

ASTM Standards on Petroleum Products and Lubricants, 6 x 9 inches, 1243 pages, hard cover. Copies may be obtained from ASTM Headquarters, 1916 Race St., Philadelphia 3, Pa. $8.25.

This publication brings together in convenient form the various ASTM standard and tentative methods of test and specifications pertaining to petroleum products and lubricants.

There are 187 standards of which 57 have been revised, have had their status recently changed or are new in this edition. This edition supersedes the December 1957 edition and should prove most valuable to petroleum chemists, engineers, and technologists. Some of the topics covered are: crude petroleum, liquefied petroleum gases, butadiene, motor and aviation fuels, petroleum solvents, diesel fuels, distillate and residual fuels, kerosene and illuminating oils, lubricating oils, industrial oils, turbine oils, electrical insulating oils, greases, petrolatums, paraffin waxes, and spray oils.

Included also as information only are 14 proposed methods of test which are published in draft form for the purpose of soliciting comments. Such proposed methods have not been formally approved by the Society and are distinguished from the standards and tentatives by the absence of an ASTM serial designation.

New Film Releases

A Sealed System for High Moisture Grain. 16 mm, 23 min., color, sound. Produced by Harvestore Products, A. O. Smith Corp. For information write A. O. Smith Corp., Education and Training Dept., Milwaukee, Wis.

Story tells how father and son work out plan to put profit back into farm operation through use of vertical farming, and sealed oxygen free storage of grain. Recommended for all ages, 14 up. Available free for showing to groups.

The Agriculture Story. 16 mm, 13½ min., color, sound. May be obtained from the Motion Picture Service, Office of Information, U.S. Department of Agriculture, Washington 25, D. C.

Dramatizes the elements that achieve success in the history of man—the forces of nature, the gifts of science and research, and the labor of American farmers and their machines operating in a free economy. Highlighted are the inter-related services of the United States Department of Agriculture — Research, education, conservation stabilization, regulatory, credit and marketing. Revealing color shots, from various crop-producing regions in the United States, capsule American farming and the processing of farm products. Cattle and crops, forest and range, grain elevators and experiment stations, farmers and 4-H members are interwoven to create the colorful pattern of today's American agriculture.

. . . New Products

(Continued from page 228)

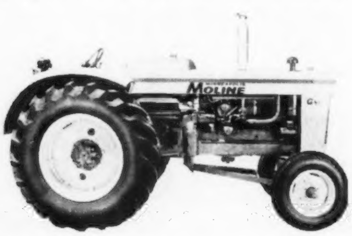
Two-Way Disk Plow

International Harvester Co., 180 N. Michigan Ave., Chicago, Ill., announces a new two-way disk plow featuring a quick-

switch operating lever which reverses the blades to throw soil either to the left or right. The unit is available with 2 or 3-point hitch and will cut and turn a strip 20 in. wide and work as deep as 12 in. It is hydraulically raised, lowered, and depth adjusted. The plow has 26-in. clearance under the beam and 21 in. between disks. Disk blades are available with inside or outside bevel cutting edges.

New Six-Cylinder Tractor

Minneapolis-Moline Co., Hopkins, Minn., announces its new G-VI tractor which is equipped with a 6-cylinder engine said to



develop 81 belt and 72 drawbar horsepower on LP gas. The engine develops slightly less power when operated on diesel fuel. The tractor weighs approximately 7600 lb, has a wheelbase of 96 in. and turns in a radius of 16 ft, 4 in. Field speeds range from 2 to 7 mph with travel speeds ranging from 11.3 up to 17 mph.

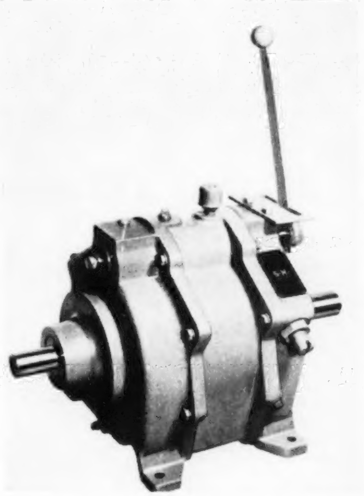
Offset Tractor

Tractor and Implement Div., Ford Motor Co., Birmingham, Mich., announces a new multipurpose offset tractor developed to

give visibility for precision-controlled one-row cultivating work and two-three plow power for other field operations. It is of high-clearance design with adjustable wheel spacing for such specialized use as vineyard and nursery work, vegetable and tobacco cultivation, as well as general farm operations. The driver's seat, steering wheel and foot controls are placed 8 in. to the right of center to give the operator clear visibility alongside the machine to the ground. The chassis of the tractor is offset 8 in. to the left and is counterbalanced by an extra heavy right rear axle. Front wheel spacing can be varied from 40 to 78 in., and rear wheels can be adjusted to give proper setting for all row-crop spacing.

Reversing Transmission

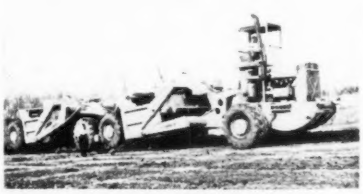
Snow-Nabstedt Gear Corp., Industrial Div., Hamden, Conn., announces a new 5-in-1 reversing transmission, in which two



forward speeds, neutral, reverse and reduction are combined in a single, compact unit that reverses under full load. The new unit is said to transmit up to 28 hp at a maximum recommended input speed of 2000 rpm. The reduction ratio is 1.97 to 1 and 3.34 to 1 in forward speeds and 3.37 to 1 in reverse. The unit is $15^{11}/_{16}$ in. long, 14 in. wide and $14\frac{3}{4}$ in. high.

Electric Road Builder

R. G. LeTourneau, Inc., 2399 South MacArthur, Longview, Texas, has introduced a new electric wheel road-building machine



designed to self-load and haul up to 50 tons of dirt each trip. The power system includes a big electric motor geared directly to the "hub" of each individual wheel. Also other powerful motors are spotted over the machine wherever power is needed. A dynamo under the hood, driven by a 600-hp diesel engine, furnished electricity to all the motors.

Two separate "buckets" are used to make possible the self-loading feature. Electric power in all eight wheels lets the rear bucket serve as a pusher to help load the front bucket; then weight of the loaded front bucket increases tire traction to help pull-load the rear bucket. Average combined loading time for both buckets is said to be $1\frac{1}{4}$ minutes. The new machines are 7 ft long, 12 ft wide, and reportedly cost about $125,000. Tires are more than 6 ft tall and $2\frac{1}{2}$ ft wide.

PERSONNEL SERVICE BULLETIN

NOTE: In this bulletin, the following listings current and previously reported are not repeated in detail; for further information see the issue of AGRICULTURAL ENGINEERING indicated. "Agricultural Engineer" as used in these listings is not intended to imply any specific level of proficiency or registration as a professional engineer. Items published herein are summaries of mimeographed listings carried in the Personnel Service, copies of which will be furnished on request. To be listed in this Bulletin, request form for Personnel Service listing.

POSITIONS OPEN — 1958 — NOVEMBER — O-330-834, 331-835, 344-838. DECEMBER — O-352-839, 349-841, 349-842, 362-844. 1959 — JANUARY — O-418-845. FEBRUARY — O-13-901. MARCH—O38-903, 39-904, 41-905, 45-906, 45-907.

POSITIONS WANTED — 1958 — NOVEMBER — W-332-55, 324-56, 339-59, 318-60. DECEMBER — W-347-61, 345-62, 346-63, 358-64, 363-65, 364-66. 1959 — JANUARY—W-355-67, 383-68, 411-69, 412-70, 406-71, 419-72, 422-73. FEBRUARY — W-9-1, 17-2, 22-3, 23-4, 20-5. MARCH — W-25-6, 26-7, 32-8, 33-9, 30-10.

NEW POSITIONS OPEN

AGRICULTURAL ENGINEER for assistant manager of agricultural department of major building material manufacturer, to provide technical assistance to regional fabricators, and cooperate with equipment manufacturers in designing of building package. Also participate in field days, open house demonstrations, and fair exhibits. Midwest location. Age 25-35. MSAE or equivalent, with training in structural design. Farm background. Several years experience in farm structures field. Able to work well with people and enjoy meeting new people. Excellent opportunity with fast-growing program. Salary open. O-50-908

AGRICULTURAL ENGINEERS (several graduate research assistantships all areas) for half-time work and half-time graduate study, in a northeastern state university. Varied research program permits adaptation of program to individual needs, desires, and capabilities. BSAE or equivalent with above-average scholarship. Genuine interest in determining fundamental relationships basic to development of improved farm equipment, structures, soil and water practices, and crop handling methods. Excellent opportunity to qualify for more advanced position. May take up to 12 credit hours per semester. Arrangements for teaching assignments at option of the individual. Salary $2,000 plus tuition for half-time research. O-55-909

AGRICULTURAL ENGINEER with experience in some phase of formula feed industry to join staff of mid-western university in position of either associate or full professor. The duties involve teaching and research. Applicants should preferably have a PhD degree and must have at least the MS degree with experience in the formula feed industry. Salary approximately $10,000 per year. O-58-910

AGRICULTURAL ENGINEER for research, design and development of tillage, green hay harvesting, and farm materials handling equipment, with full-line manufacturer in Midwest. Age 25-30. BS in agricultural or mechanical engineering. Experience 1 to 3 years in similar work with farm equipment manufacturer. Ability to work with and lead people. Excellent opportunity to advance in product engineering and in related fields. Salary open, depending on experience and technical training. O-56-911

AGRICULTURAL ENGINEER for farm equipment advertising copy writer with agency in Midwest. Age 21-28. BSAE, with some training in journalism desirable. Must be familiar with modern mechanized farming and have good aptitude for writing. Experience in farm equipment sales or writing on farm equipment desirable. Open field for advancement in varied lines of advertising work, due to large number of farm advertising clients served. Salary open. O-59-912

AGRICULTURAL ENGINEER for design and development with established manufacturer of agricultural sprayers and related equipment. Experience 3 or more years with latest methods of hydraulic and air-blast spraying. Good knowledge of aerodynamics and axial fan design. Work will follow through from design and field tests to final production. Favorable living conditions in pleasant, medium-sized eastern city with good schools and recreational

. . . Personnel Service

facilities. Permanent position with growing company. Salary open, depending on training and experience. O-71-913

NEW POSITIONS WANTED

AGRICULTURAL ENGINEER for sales promotion or administration in electric power and processing field with industry or trade association, preferably in eastern U.S. Willing to travel. Single. Age 34. No disability. BSAE, 1951, Virginia Polytechnic Institute. Experience 4 years as agricultural engineer with electric utility; 3 years as coordinator of state farm and home electrification council. Military service in merchant marine. Available July 1. W-54-11

AGRICULTURAL ENGINEER for application, research or teaching in soil and water or farm structures field with public service or industry, any location. BSAE expected in July, Texas Technological College. Married. Age 22. No disability. Experience as student assistant in agricultural engineering department, part-time instructor in surveying, work with underground recharge project, and reporter for ASC. Available July 20. W-70-12

AGRICULTURIST for extension, teaching, or management, in power and machinery or soil and water field with manufacturer, processor, distributor, consultant, or federal agency, preferably in Northeast. Married. Age 41. No disability. BSA, 1952, Univ. of Florida. Farm background. Assistant director of agriculture 7 mo. and director of agriculture 29 mo., Government of American Samoa. District sales manager for manufacturer of specialized farm equipment, 3½ years. Leadership in numerous local civic activities. Available on 30 days notice. Salary $8-10,000. W-72-13

The following is a list of recent applicants for membership in the American Society of Agricultural Engineers. Members of the Society are urged to send information relative to applicants for consideration of the Council prior to election.

Bennett, George K.—Grad. student in agr. eng., Cornell University, Riley-Robb Hall, Ithaca, N. Y.

Colon, Victor C.—Spec. in cooperatives, III Farm Machinery Co-op., Administration for Cooperative Dev., Santurce, Puerto Rico. (Mail) 1900 W. Clinch Ave., Knoxville, Tenn.

Cranston, James W.—Agr. sales mgr., Berglund Tractor and Equipment Co. (Mail) 1018 Soscol Ave., Napa, Calif.

Dunham, Don E.—Work unit engr., (SCS) USDA. (Mail) 5686 E. Kaviland Ave., Fresno, Calif.

Eaton, Ernest E.—Dir. of eng., Clark Equipment Co., Transmission Div., 1300 Falahee Rd., Jackson, Mich.

Ghere, David P.—Grad. trainee, Allis-Chalmers Mfg. Co. (Mail) 9401 W. Coldspring Rd., Milwaukee 19, Wis.

Gilliam, Jack L.—Gen. factory mgr., Massey-Ferguson Inc., 12601 Southfield, Detroit, Mich.

Hoyt, Howard C.—Agr. engr., agr. eng. dept., University of Delaware, Newark, Del.

McDaniel, Don R.—Agr. engr., (SCS) USDA. (Mail) 2621 Monroe Ave., Ashland, Ky.

McGill, Dan M. — Grad. student, res. asst., Clemson Agricultural College. (Mail) R. 4, Anderson, S. C.

Nagorski, John W. — Agr. engr., (SCS) USDA. (Mail) 1380 W. Florida Ave., Hemet, Calif.

Perkins, James G.—Asst. dist. mgr., International Harvester Co. (Mail) P.O. Box 869, Jacksonville 1, Fla.

Reiter, Robert A. — Test engr., International Harvester Co., 1100 Third Ave., East Moline, Ill.

Roberts, John W.—Agr. engr., Duke Power Co. (Mail) 103 Fredericks St., Anderson, S. C.

Shibberu, Wolde M.—Grad. student in agr. eng., Kansas State College. (Mail) 1421 Legore Lane, Manhattan, Kans.

Shuler, Norman E. — Agr. engr., (SCS) USDA. (Mail) P.O. Box 348, Anderson, S. C.

Simons, George C. — District mgr., Morse Chain Co., Div. of Borg-Warner Corp., 1630 Fifth Ave., Moline, Ill.

Soffer, Arie T.—Res. and des., Rural Building Research Bureau, 121 Alenby Rd., Haifa. (Mail) Smaar-Mefer, P.O. Beit-Itzhak, Israel

Stohler, J. Lester—Sr. designer, eng. dept., New Holland Machine Co., Div. of Sperry Rand Corp. (Mail) 142 Martin Ave., Ephrata, Pa.

Terpstra, Earl A.—Watershed engr., (SCS) USDA. (Mail) 109 E. Oak St., Washington, Ind.

Thiele, Frederic W. — Pres.-owner, Material Handling Systems Co., Box 89, Colon, Mich.

Thornton, Howard — Sr. partner, Thornton Brothers, agr. eng. and constr., and U.S. Army Corps of Engrs. (Mail) 1215 Old Hickory Rd., Memphis, Tenn.

Titus, Charles R.—Eng. draftsman, International Harvester Co., East Moline Works, East Moline, Ill.

Townsend, Harold B., Jr.—Agr. and proj. engr., (SCS) USDA. (Mail) P.O. Box 232, Bethany, Mo.

Vallejo, Carlos A. — Student, California State Polytechnic College. (Mail) Calle 13 Norte #7-43, Cali, Colombia, South America.

TRANSFER OF MEMBERSHIP

Bodine, William S.—Gen. supt. and secy., Roosevelt Water Conservation District. (Mail) 3028 E. Mitchell Dr., Phoenix, Ariz. (Associate Member to Member)

Johnston, Grant M. — Prod. engr., International Harvester Co. of Canada Ltd., Sherman Ave., N., Hamilton, Ontario, Canada (Associate Member to Member)

Lawson, Lewis E. — Mgr. of agr. eng., Green Giant Co., Le Sueur, Minn. (Associate Member to Member)

Morgan, Eugene P.—Field engr., American Factors, Ltd., P.O. Box 3230, Honolulu, T. H. (Associate Member to Member)

Schumacher, Walter B.—Designer, New Holland Machine Co. (Mail) 188 Hillcrest Rd., New Holland, Pa. (Associate Member to Member)

Woodward, Guy E.—Eng. staff asst. to the ch. engr., New Holland Co. (Mail) 208 W. Conestoga St., New Holland, Pa. (Associate Member to Member)

STUDENT MEMBER TRANSFERS

Anderson, Klennes H.—(North Dakota State College). (Mail) Deere & Co., Moline, Ill.

Bauerband, Raymond D. — (University of Georgia). (Mail) 240 Boulevard, Monroe, Ga.

Gay, Eugene T.—(University of Georgia). (Mail) R.R. 1, Hartsfield, Ga.

Gibbs, William T.—(University of Georgia). (Mail) Ty Ty, Ga.

Hughes, Howard F.—Agr. eng. dept., North Dakota Agr. College. (Mail) 1303 13th St., N., Fargo, N. D.

Knudson, Henry T. — Agr. eng. dept., South Dakota State College. (Mail) 911 7th St., Brookings, S. D.

Sharp, Don E.—(University of Tennessee). (Mail) R.R. 1, Seymour, Tenn.

Van Lent, John H., Jr.—(South Dakota State College). (Mail) State Highway Dept. Office, Sioux Falls, S. D.

Williams, Edward N.—Agr. eng. dept., University of Georgia, Athens, Ga.

Index to Advertisers

ADVERTISING REPRESENTATIVES

New York 17 — BILLINGSLEA AND FICKE, 420 Lexington Ave. LExington 2-3667

Chicago 2—DWIGHT EARLY AND SONS, 100 N. La Salle St. CEntral 6-2184

San Francisco 5 — McDONALD-THOMPSON, 625 Market St. YUkon 6-0647

Los Angeles 5 — McDONALD-THOMPSON, 3727 W. Sixth St. DUnkirk 7-5391

Seattle 4 — McDONALD-THOMPSON, 1008 Western Ave. MA. 3-3766

Portland 1 — McDONALD-THOMPSON, 404 Times Bldg. CApital 2-5146

Denver 3 — McDONALD-THOMPSON, 620 Sherman St. KEystone 4-4669

Houston 6—McDONALD-THOMPSON, 3217 Montrose Blvd. JA. 9-6711

Tulsa 4 — McDONALD-THOMPSON, 2010 South Utica. RIverside 3-1981

Phoenix — McDONALD-THOMPSON, 541 West Claremont. CRestwood 4-1342

Advertising Manager: RAYMOND OLNEY, 420 Main St., St. Joseph, Mich. YUkon 3-2700